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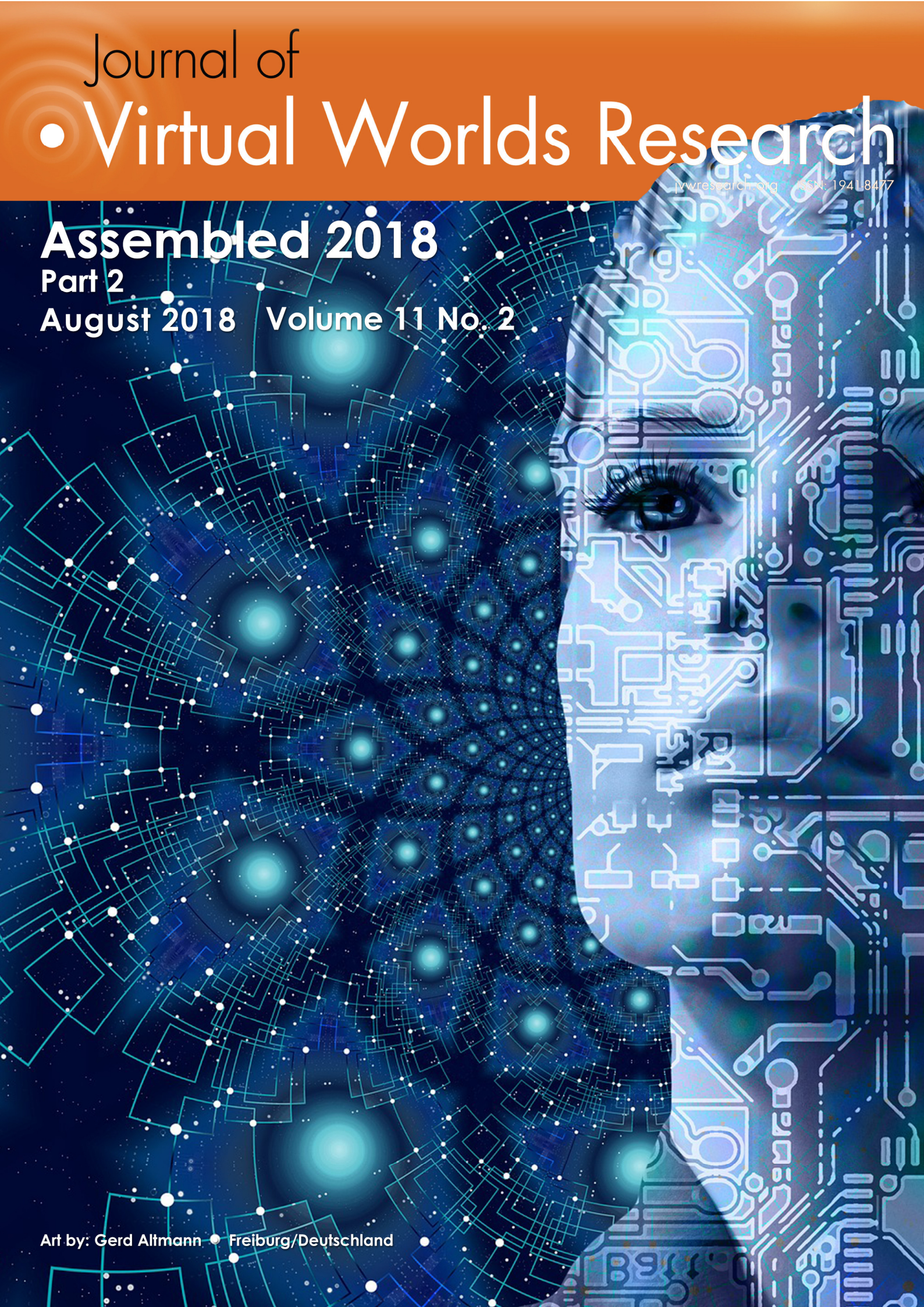

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Gaming the Performance: Massively Multiplayer Online Games and Performance Outcomes in English and Business Courses

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Abstract

The push for technology integration in classrooms calls for examinations of available options, particularly those that have not yet been used to their full potential for various reasons. One such technology is digital commercial games which, though designed for entertainment, may have potential educational benefits. Although there have been several discussions in the literature about the possibilities of such commercial video games as educational assets, there persists a gap in our understanding of the value of such games in the context of Higher Education. This gap is particularly visible when it comes to studies on how commercial games may affect performance outcomes in multiple disciplines. Thus, this study examined Massively Multiplayer Online Games (MMOGs), one genre of commercial games, in two disciplines, to discover how, and if, they improved learner performances. This information could help facilitate technology integration in new and interesting ways for institutions, instructors, and instructional designers. Using a True Experimental design that examined the performance scores of 214 students in English and Business courses, the effect of using MMOGs on participation scores was analyzed from multiple statistical perspectives. The findings strongly suggest that using MMOGs helped experimental groups to perform better. Additionally, there are strong indications that game related content like game wikis, blogs, game site information, and game video tutorials was also instrumental in improved performance, irrespective of active gameplay or not. This is significant as it may provide easier-to-integrate options for MMOGs in the curriculum. Practitioner, theoretical and research implications are also discussed.

1. Introduction

The educational value of the genre of commercial video games (made for entertainment purposes, not for education) has been discussed, to some extent, in the literature. Massively Multiplayer Online Games or MMOGs are a sub-genre of games within the commercial game's genre. MMOGs are games in which large numbers of players worldwide participate in game-related activities and goals within an online, virtual world (Coiro, Knobel, Lankshear & Leu, 2008). MMOGs are the most widely used, and the most played commercial games worldwide (Broekens, 2008; Delwiche, 2006; ESA, 2016; SuperData Research, 2016). This makes this commercial video game category an ideal subject for educational research, given the push for integrating technology in classrooms (Dillenbourg & Jermann, 2010; Johnson, Becker, Estrada & Freeman, 2015; Lawless & Pellegrino, 2007). Besides its widespread usage and ready availability, MMOGs have been known to possess other qualities that have endeared this genre to researchers. For instance, MMOGs can provide highly interactive ways to learn (Hung, Kinzer & Chen, 2009; Killi, 2010; Marvel, 2012; Paraskeva, Mysirlaki & Papagianni, 2010; Romero, 2016; Tsai, 2016; Van Eck & Hung 2010), while using techniques such as virtualization and socialization that add to the engagement factor (Szell & Thurner, 2010).

Analysts have predicted the growth of the MMOG market, due to the powerful, social emotions they elicit in players (Suárez, Thio, & Singh, 2013), while researchers like Schrader and McCreery (2008) consider MMOG environments to be immersive enough to "provide a structured context intended to promote the necessary skills to accomplish complex, goal-based tasks. Learners are empowered through a dynamic, interconnected process that scaffolds both technological skills sets and content knowledge" (p.571). Thus, MMOGs bring developmental and supportive tools to learners at all levels of expertise (Schrader & McCreery, 2008).

However, despite these positive conceptions, there are gaps in the literature regarding the subject of MMOG as learning tools in the context of performance outcomes in learners. Additionally, the trend in the current literature is to study single MMOGs at a time, which may be problematic when studying the co-relation between MMOGs and performance/engagement, as it may leave a significant gap in our understanding of the value of MMOGs as a commercial game sub-genre. Given the vast array of MMOGs available, it is possible that attempts of extrapolation may be limited by the lack of knowledge of the aspects of the games that give them their true value, versus estimated assumptions of their value. Finally, there are gaps in investigating the effects of digital game-based interventions in a multidisciplinary context (Van Eck, 2015). Thus, this study examined the performance outcomes of 214 students enrolled in Associate Degree Programs in the School of Liberal Arts and School of Business of a large, Midwestern community College. The purpose of this study was to address such gaps and provide some insights into the effects MMOGs may have on learner performance, irrespective of their gaming expertise and background when multiple games are used across disciplines. Two disciplines of English and Business were used. The goal was to examine the broad-spectrum effects on learner performances using MMOGs.

In the context of the use of MMOGs across disciplines, there is evidence of its value in disciplines such as English and Business, albeit to a limited extent. With respect to English learning, there are studies on the use of MMOGs in Computer Assisted Language Learning or CALL (Peterson, 2009, 2010). Network-based games can assist in language competencies for ESL learners through the opportunities of social interaction and collaborative communications with peers (Ang & Zaphiris, 2007; Peterson, 2010). Other studies relate to examining the effects of prior knowledge on English proficiency gains using MMOGs (Huang & Yang, 2014; Lee & Pass, 2014; Liu, Yang & Huang, 2012; Yang & Hsu, 2013), using MMOGs in elementary English education to increase listening, reading, and writing scores of experimental groups (Suh, Kim & Kim, 2010), safe learning

spaces for ESL that MMOGs can provide (Kongmee, Strachan, Pickard & Montgomery, C, 2011), and the ability of MMOGs to inspire students to write more prolifically (Martin, 2011).

There are only a few studies regarding performance outcomes using MMOGs in teaching Business related courses in Higher Education. Some important ones in this context include Fu, Hainey, and Baxter (2016) whose study found some evidence of better performance outcome using entertainment games and highlighted the need for more studies on this topic. Harviainen and Vesa's (2016) meta-theoretical article combined existing empirical findings to identify how MMOGs can be used as tools to teach organizational and procedural literacies to employees. Munir, Barry, and Andrew (2016) discussed the value of using MMOGs for teaching business and marketing. Monetizing options in MMOGs relies heavily on business and marketing principles, as well as highlights some ethical and legal aspects of business. Thus, they can be useful as teaching and learning tools for Business principles (Castranova, 2001).

This also relates to the concept of RMT or Real Money Trading, wherein "Players can circumvent the internal economy of a game by purchasing the items they wish to acquire for real money" (Constantiou, Legarth & Olsen, 2011, p.105). Some studies on RMT include investigations on why players spend real money in MMOG worlds (Constantiou, Legarth & Olsen, 2011; Guo & Barnes, 2007), examining macroeconomic theories such as overlapping generation model and endogenous growth theory that could be helpful to understand in-game economy (Huhh, 2008), testing models to detect real money traders through trading networks (Fujita, Itsuki & Matsubara, 2011), examining legal and policy perspectives related to RMT (Yoon, 2008), and the effects of RMT on MMOG demand and sales (Huhh, 2006).

2. Literature Review

MMOGs are powerful agents of motivation, based on their ability to sustain user interest and stamina over long periods (Yee, 2006; Zhang & Kaufman, 2015), Recent data on MMOG usage indicates players play from 4 to 6 hours a week (ESA, 2016). MMOGs create motivation through emotional incitements that may influence students' self-regulation, which in turn may affect academic achievement (Mega, Ronconi, & De Beni, 2014). This is important when viewed through educational lenses. Motivation is a crucial factor in designing and experiencing meaningful and effective learning (Devlin & Samarawickrema, 2010; Hativa, Barak, & Simhi, 2001). Students who are interested in a task will be more motivated to learn (Schunk & Zimmerman, 2012). "Motivational lapses due to instrumental limitations often lead to resignation and surrender" (Denis & Jouvelot, 2005, p.462), In the context of video games, two entertainment factors: pleasure and desire, lead to intrinsic motivation. This, in turn, leads to creating a symbiosis between fun, learning, curiosity, and proficiency through arousal and control (Denis & Jouvelot, 2005), because in some respects motivation is more important than intelligence in terms of learning outcomes (Côté & Levine,2000).

The concepts of intrinsic and extrinsic motivation, self-efficacy, and cognitive engagement are crucial in the context of MMOG usage in education. While intrinsic motivation originates from an individual's own desire and extrinsic motivation originates from factors outside of self. Intrinsic motivation leads to satisfaction and pleasure in the learning process as learners gain competencies and knowledge through self-propelled motivation, while extrinsic motivation leads to completion of tasks to gain outcomes other than self-satisfaction, such as grades or other rewards (Deci & Ryan, 2000). Students who are intrinsically motivated are more compelled to persist when facing learning challenges (Boyd, 2002), because intrinsic motivation aids positive self-image and creativity (Cokley, Bernard, Cunningham, & Motoike, 2001; Moneta & Siu, 2002), In the context of using commercial games in education, research indicates that such games enhance intrinsic motivation in users. In fact, players play games because of the intrinsic satisfaction they get (Bartle, 2004; Ryan, Rigby & Przybylski, 2006).

The motivational pull of commercial video game contents are also derived from presence, or the immersive nature of such games, which allows players to experience intrinsically, where they sense that they are within a game, instead of being an outsider looking in (Lombard & Ditton, 2006; Peña & Chen, 2017; Rigby, 2004; Weibel, Wissmath, Habegger, Steiner & Groner, 2008). This relates to the theory of self-efficacy, wherein a person's belief in the capacity to perform a task successfully can be a potent motivator for action or inaction. According to Bandura (1977), self-efficacy expectations are derived from four factors, "performance accomplishments, vicarious experience, verbal persuasion and physiological stages" (p.191). Research indicates that learners with higher self-efficacy are more likely to succeed in the face of challenges (Chemers, Hu & Garcia, 2001; Hsieh, Sullivan & Guerra 2007; Schwarzer, 2014; Zimmerman, 2000). In the context of using MMOGs in education, research suggests that MMOGs influence user self-efficacy through socialization and built-in incentives, which in turn impact learning outcomes (Hopp, Barker & Schmitz Weiss, 2015; Klimmt & Hartmann, 2008). Cognitive engagement relates to how learners feel about themselves in relation to their work and skills, as well as their abilities to employ strategies to gain mastery (Metallidou & Vlachou, 2007). Commercial video game generated motivation also relates to cognitive engagement in learning activities, thus ensuring student successes (Blumenfeld, Kempler & Krajcik, 2006; Walker, Greene & Mansell, 2006).

The highest form of cognitive engagement is found in self-regulated activities that allow a high degree of personal control and autonomy (Stoney & Oliver, 1999). Cognitive engagement is influenced by achievement goals, which, in turn, influences academic achievement (DeBacker & Crowson, 2006). In the context of commercial video games, cognitive engagement takes the user experiences beyond the realm of immersion, through features such as control over character customization that allow players to relate to their own worldviews and personal choices. Lankoski (2011) contends that the ability to personalize and customize makes users react to game characters in a manner that is like the way that they react to real people. Customization also allows players to be more engaged, with an increased amount of gameplay over time (Turkay & Adinolf, 2015). Additionally, as Hoffman and Nadelson (2009) suggest, gaining this kind of control over their video game-based learning environment also ties into increased self-efficacy.

MMOGs have been used as motivational tools both in Higher Education and K-12 environments. However, there is a gap in the literature when it comes to multidisciplinary settings (Van Eck, 2015) that this study seeks to explore. Examples of ways in which MMOGs assisted in motivation include offering learners superior challenges and levels of satisfaction (Hainey, Connolly, Stansfield & Boyle, 2011), providing opportunities to enhance learners' cognitive abilities (Corredor & Benavides, 2016), ensuring enhanced enjoyment as compared to other digital games (Suárez, Thio &Singh, 2013), creating the possibility of enhancing acquisition of skills and expertise (Schrader & McCreery, 2007), providing the option of being used as research and practice tools (Sykes, Reinhardt & Thorne, 2010), and allowing learners leadership and socializing opportunities (Lu, Shen, & Williams, 2014; Mysirlaki, & Paraskeva, 2012). MMOGs promote skills such as communication, evaluation of information, research, problem-solving, and literacy, due to their immersive environments, and built-in scaffolds for technological and content knowledge (Schrader, 2008). MMOGs may prove useful as motivational tools in instructional design, from both student and teacher perspectives, who may be attracted to MMOG elements, such as competition and augmented critical thinking (Schultheiss, 2007), the ability to facilitate cognitive, social and affective aspects of online environments (Voulgari, Komis, & Sampson, 2014), and the possibility of increased intrinsic motivation due to extreme socializing (Godwin-James, 2014; Mysirlaki & Paraskeva, 2011; Thorne, 2010).

The educational value of most commercial video games, including MMOGs, can be better understood using the factors that motivate players to play or gravitate towards specific games. These factors are seen in both the gameplay, as well as the game related contents that provide information

about the gameplay. The gameplay mechanics are the interactive game cycle within which players carry out their activities, based on the information they receive from the game environments. Such information is transmitted in three ways. First, there are sensual stimuli such as visual and aural. Then, there are psychological stimuli such as tactile (force-feedback interfaces), overcoming challenges, and extrapolating game experiences with real life. Finally, there are social stimuli such as collaborative playing, intensified social dialogues and possible cross-cultural interactions (Adams & Dormans, 2012; Sicart, 2008). These hold users' attention in emotional ways, leading to the fulfillment of entertainment and engagement (Fabricatore, 2007). Gamers are attracted to attributes that may be common to both game and learning environments, such as opportunities for being challenged, ability to control what surrounds them, developing a sense of mastership and achievement, and built-in reward systems (Fabricatore, 2007; Hense & Mandl, 2014). For instance, MMOGs have problem-solving components within their mechanics and contents, emulating Cognitivism learning theories, while Constructivism is apparent in MMOGs due to the problem-based activities (Hense & Mandl, 2014).

Even though they were not designed for education, MMOGs can be highly useful learning tools when fused with sound curricular designs (Ahmadi & Jazayeri, 2014; Henderson & Romeo,2015; Voulgari, Komis, & Sampson, 2014; Moreno-Ger, Burgos, Martínez-Ortiz, Sierra & Fernández-Manjón, 2008; Wu, Richards & Saw, 2014). This is possible because MMOGs have a mixture of built-in mechanisms that heighten motivation, engagement, and learning that make them conducive to improving learning (Biggs & Tang, 2011; Kahu, 2013; Malliarakis, Satratzemi & Xinogalos, 2014; Zepke & Leach, 2010). MMOGs also increase players' understanding of different value types based on their emotional reactions to the games (Rezaei & Ghodsi, 2014), and foster collaboration and critical thinking, due to sociability, achievement, challenges, competition, and increasing immersion (Voulgari, Komis & Sampson, 2014).

Student preferences of games may also be a deciding factor in how they can learn from games. Such preferences may also provide some clues as to which games teachers and instructional designers could select. Gamers, in general, are attracted to features such as rich social interaction through groups, guilds, and player alts (secondary characters), options for extensive socializing and enhanced immersion, pseudonymity using avatars or alternate- virtual personas, options for long-distance interactions with friends and other players, options of long-term commitments between players, options for modding or creatively modifying game software, and economic values such as free-to-play options (Adams, 2013; Lin & Sun, 2015; VandenBerghe, 2013). An examination of fifteen MMOGs, including the seven ultimately selected for this study (Cyber Creations Inc, 2017), revealed that these games have all the features listed above.

Thus, it is evident that commercial games like MMOGs have several elements to augment learning experiences and motivation, which creates the need to pursue investigations, possibly in a multi-disciplinary context, of the extent of influence such games may have on learning within Higher Education. Since performance outcomes are one of the credible ways to evaluate an educational technology (John Hopkins University, 2015), and given the dearth of such examinations in the literature, it will be valuable to examine such games in the context of learner performances, using the commercial game sub-genre of MMOGs, which is the foci of this study.

2.1. Research Questions

To achieve triangulation and get a more extensive look at performance outcomes, they were examined from several angles that included choices participants made regarding the way in which they used MMOGs. To effectively measure performance outcomes, this study evaluated learners' critical thinking skills, by fusing the student activities and lesson plans with meta-cognitive opportunities to facilitate problem-solving (Eseryel, Law, Ifenthaler, Ge, & Miller, 2014; Kim, Park

& Baek, 2009). The questions examined were: (1) What are the effects of the use of Massively Multiple Online Games on students' performance outcomes with respect to overall performance in assignments? (2) What are the effects of the use of Massively Multiple Online Games on students' performance outcomes with respect to critical thinking in essay or research type activities? (3) How are participants' performance affected regarding whether they played the games versus only interacted with game content versus did both (play game and interact with content)? (4) How are participants' performance affected by choice of games they select for their learning?

3. Methodology

3.1. Design Overview

This study used a True Experimental design/methodology (Johnson & Christensen, 2014) with randomization, control, and manipulation. Associates level courses in English and Business programs within two regions of a large Midwestern Community College were selected, using randomized course reference numbers (CRN), for overall participation, as well as being divided into experimental and control groups. For commercial games, 7 MMOGs were selected based on the game-factors that attract gamers, as discussed in the Background section, as well as requirements of the institution's administrators. These requirements were free-to-play, PC platform, online, and non-shooter games. For English, the selected games were Rift, Skyforge, Tera Rising, Elvenar, and Age of Conan. Business course experimental participants used Elvenar, Virtonomics, and Anno Online.

Experimental groups were required to select one game from a set of assigned MMOGs, while control groups did not use any game. The teaching and assessment methods and materials, except for MMOG inclusion, were same for both experimental and control groups within disciplines. However, the materials and assessments differed, based on the discipline. All course materials adhered to the sponsoring institution's curriculum goals and requirements. The games were used for both learning and evaluation. Experimental students used the games as tools to augment their understanding of what they learned from lectures and textbooks and help with developing critical thinking skills. Performance outcomes were measured through multiple instruments as detailed in Table 1 in the Data Collection sub-section. Students made crucial decisions regarding game selection, game related reading or playing selection, topics for persuasive essays, relationships of Business principles to the games, and reflecting on their game-related learning. The activities, including the surveys, were part of the course package, and students were not required to do anything else outside of class.

3.2. Site and Participants

Upon receiving approval from the Institutional Research Board (IRB), data was gathered from two regions of a Midwestern Community College. Participants were 214 students enrolled in Associate Degree Programs in the School of Liberal Arts and School of Business and 6 faculty members. The target population for the regions is approximately 6000. Based on the survey data, students were mixed in terms of ethnicity and gaming background plus computer usage. Sixty-nine percent were 19 to 25 years old, with the balance being in the 26 to 65 range. Forty-five percent of Business students had never played MMOGs before, 48% had played but not for class work, while 7% had never played video games. Forty-three percent of English students had never played MMOGs before. 55% had played MMOGs, but never for a classroom project, while 2% had never played any video games before. Essentially, most participants were novices with respect to using MMOGs in classroom settings, but approximately half of them had some gameplay experience. Figure 1 provides a graph of the game related experience of participants.

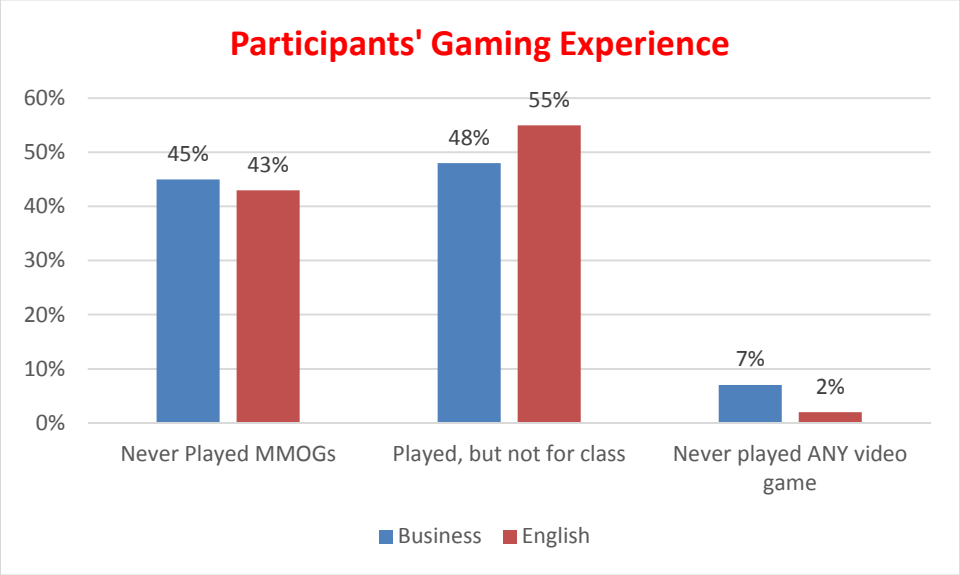

Figure 1: Participants' Gaming Experience

3.3. Data Collection

Data related to coursework and scores were gathered using assignments that followed the strict guidelines of the institutions' current curriculum, and that all instructors were required to use. As per the institutional stipulations, the only changes to the assignments were in terms of the use of games. Assignments varied based on discipline. One survey was used to gather demographic data. Three surveys were used for research question 3 and 4 related information, including choices. Experimental participants were given autonomy in game selection and how they preferred to use them. Thus, they could use game related content such as game wikis, blogs, game site information on characters, lore, locations, as well as textual and YouTube video tutorials. Alternatively, they could play the game or combine content browsing and gameplay. Control group participants did not use any games for their learning. Everything else was identical between the two groups' learning environment. Table 1 summarizes instruments for this study.

Table 1: Data Instruments per RQ for Each Discipline

RQ #	Business	English
1	Final semester scores; Mid Term and Final Exam scores; exams were multiple choices, proctored and timed.	Scores for Summary and Response essay, Rhetorical Analysis essay, Topic Proposal and Classical Argument essay; Final semester scores
2	A three-part, Gaming-for-Learning Project that only experimental students worked on throughout the semester. The rubric for this assignment was used to segregate CTE from other criteria	Essay rubric sheets that identify critical thinking elements (CTE)
3	Assignment and exam scores were analyzed using choices criteria: data pertaining to choices were collected using three short surveys with 5 questions each, one for each discipline. The surveys asked experimental group participants to specify what game they selected; if they played the game or only interacted with the contents or did both, and what were their opinions on having such choices.	As in Business
4	As in #3	As in #3

4. Analysis and Results

Both within and between subjects' data were used for a comprehensive and in-depth analysis. To establish interrater reliability for the English courses taught by the lead researcher, an outside grader was used. The grader received de-identified data and commented on the fairness of the grades with respect to the rubric and quality of work. No adjustments were required in the scores. Table 2 summarizes the analysis process.

Table 2: Data Analysis per RQ for Both Disciplines

RQ #	Analysis
1	Between- subjects, comparing essay, exam and semester scores in percentages from experimental and control groups via Independent Sample *t*-Tests, odds ratio, and Cohen's *d* calculations.
2	Within- subjects, using the rubric items for the essays and the gaming-for-learning project, which were divided into two segments, one pertaining to critical thinking elements (CTE) and the other pertaining to items such as citation style, organization, structure and such. The percentage scores for each were determined and analyzed, using a Paired *t*-Test and Cohen's *d*.
3	Experimental participants' grades were matched to their selections and analyzed using one-way ANOVA tests.
4	As #3

Some of the initial calculations were made using the Social Science Statistics (SSS) online software, and then rechecked using the associated algorithms/formulas. Finally, they were triple checked using IBM SPSS. Details of the analysis types and resultant data are given below.

The H1 (null hypothesis) was that there would be no difference in performances between experimental and control groups. The Ha (alternative hypothesis) was that learners in MMOG based courses might have higher performance outcomes than those in regular courses that do not use MMOGs. Due to directional approach for the Ha, one-tail, independent sample *t*-Tests were used. Alpha-level for both tests were set at 5% (α = .05). The confidence level for tests was set at 95%. The significant overall results are summarized in Table 3.

Table 3: Significant Results Summary

RQ1: The experimental group participants in both disciplines had significantly higher performance scores than the control.
RQ2: The rubric for the essays for English and research paper for Business were divided into CTE or critical thinking elements and non CTE. Based on a within-subjects' analysis of Paired *t*-Tests, there was a significant difference between the scores of experimental participants, in favor of CTE, suggesting that while participants lost points on items such as APA/MLA citations, structure, and organization, they were accorded high, and even full points, for the critical thinking components of the assignment/evaluations.
RQ3: The performance score means of the three variables were analyzed using one-way ANOVA tests (Park, 2003). The results revealed no significant differences in performance outcomes between the three variables (using content alone, playing games alone, combining content usage with gameplay). This supports that game content may be just as instrumental in boosting performances as playing the games. Ergo, actual gameplay may not be required to positively affect engagement, learning, and consequent performances.

RQ4: The means of performance outcomes under each game selection category was analyzed using one-way ANOVA tests (Park, 2003), with no significant results, indicating that despite using different games, participants' scores remained statistically unaffected. Additionally, quantified survey data indicated that participants placed a high value on having multiple game selections. Ergo, using multiple MMOGs had significantly positive effects on performance.

The significant data analysis numbers per research question, or RQ, are summarized below.

RQ 1: What are the effects of the use of Massively Multiple Online Games on students' performance outcomes with respect to overall performance in assignments?

The sample included 130 students from Business courses (65 each for experimental and control) and 84 students from English courses (30 experimental and 54 control). The between subjects, Independent sample t-Test results indicate that the experimental groups' higher performance outcomes versus the control group, were statistically significant. Based on this, the null is rejected. Odds Ratio were in favor of the intervention, calculated with 80%+ as the desired range based on the institution's and general standards for Higher Education assessments in the United States (International Affairs Office, 2008), using the formula (a/b)/(c/d), where a=desired experimental, b=undesired experimental, c=desired control, and d=undesired control scores). Cohen's d effect, using Ray and Shadish's (1996) Method 2, was of high and medium significance. Table 4 summarizes the relevant and important data.

Table 4: Summary of Significant Data Analysis Numbers for RQ1

	Business Exam Scores	**Business Semester Scores**	**English Essay Scores**	**English Semester Scores**
μ (mean)	Experimental:80.47 Control: 67.22	Experimental:81.91 Control: 73.02	Experimental:83.63 Control: 69.33	Experimental: 76 Control: 62.26
***t*-value**	6.19532	3.97366	3.71	2.89
p value	.00001. Significant at $p < .05$	.000059. Significant at $p < .05$.	.000191. Significant at $p < .05$.	.002478. Significant at $p < .05$.
Cohen's *d*	High significance at 1.088 (t-value=6.20, n of mean 1: 65.00, n of mean 2: 65.00).	Medium significance at 0.696 (t-value 3.97, n of mean 1:65, n of mean 2:65).	High significance at 0.844 (t-value=3.71, n of mean 1: 30.00, n of mean 2: 54.00).	Medium significance at 0.658 (t-value 2.89, n of mean 1:30, n of mean 2:54)
Odds ratio	7.5 in favor of the intervention where a=25, b=40, c=5, d=60.	2.0 were in favor of the intervention, where a=41, b=24, c=30, d=35	3.1 in favor of the intervention where a=20, b=10, c=21, d=33.	2.375 in favor of the intervention where a=15, b=15, c=16, d=38.

RQ 2: What are the effects of the use of Massively Multiple Online Games on students' performance outcomes with respect to critical thinking in essay or research type activities?

The sample included the experimental group of 65 students from Business courses and 30 students from English courses. The results of the within-subjects, Paired t-Test indicate that participants performed significantly better in terms of Critical Thinking Elements (CTE) versus other rubric items like citation styles, organization, and structure. Cohen's *d* effect, using Morris and DeShon's (2002) Equation 8 for within-subjects, was of high and medium significance. Table 5 summarizes the relevant and important data.

Table 5Table 5: Summary of Significant Data Analysis Numbers for RQ2

RQ2	Business	English
t-value (paired t test)	-13.361223	-5.315582
p value (paired t-test)	The value of p is 1.1E-05. significant at $p \leq 0.05$.	The value of p is < 0.00001. Significant at $p \leq 0.05$.
Cohen's *d*	High significance at 1.83 where CTE Mean is 95.82, non-CTE Mean is 74.92, standard deviation 1 is 13.21 and 2 is 18.78, and correlation is 0.75.	High significance at 1.20 where CTE Mean is 89.80, non-CTE Mean is 76.60, standard deviation 1 is 7.51 and 2 is 16.53, and correlation is 0.58.

RQ 3: How are participants' performance affected in terms of whether they played the games versus only interacted with game content versus did both (play game and interact with content)?

The sample was same as in RQ 2. The one-way ANOVA test yielded *not-significant* results, suggesting that there was no difference in performance related to how learners used the games. Thus, interacting with game contents was equally beneficial for performance for those who did not wish to engage in complex gameplay. Table 6 summarizes the results.

Table 6Table 6: Summary of Significant Data Analysis Numbers for RQ3

RQ3	Business	English
ANOVA (one way)	**Exam:** *f*-ratio value is 0.28331, and *p*-value is .754244. **Semester**: *f*-ratio value is 0.57379, and *p*-value is .56635. Results are *not significant* at $p < .05$	**Essay:** *f*-ratio value is 0.11124, and *p*-value is .741217. **Semester**: *f*-ratio value is 0.00031, and *p*-value is .986146**.** Results are *not significant* at $p < .05$

RQ 4: How are participants' performance affected by choice of games they select for their learning?

The sample was same as in RQs 2 and 3. The game selection distribution was: Business= Elvenar-49, Anno 11 and Virtonomics 4; English= Elvenar-15, Skyforge 5, Rift 5, Tera Rising 4 and Age of Conan 2. Figure 2 provides a graphical display of this. The one-way ANOVA tests indicated no significant difference in performances based on game choices, suggesting that all MMOGs were helpful to boost learning outcomes. Table 7 summarizes the data.

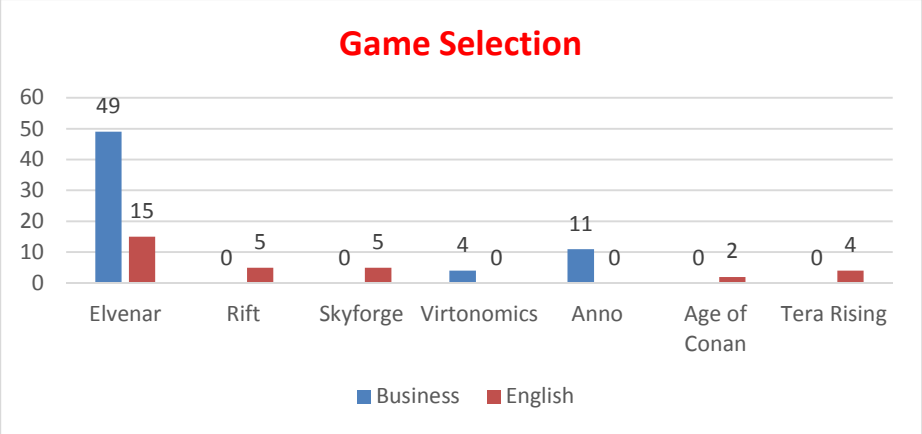

Figure 2: Game Selection by Participants

Table 7: Summary of Significant Data Analysis Numbers for RQ4

RQ4	Business Gaming for Learning Project	Business Semester	English Essays	English Semester
μ (mean) per game	Elvenar = 85.48, Anno 79.54, and Virtonomics 90.75 with the average totaling at 84.79	Elvenar =81.24, Anno 81.63 and Virtonomics 87.75, with the average totaling at 81.71	Elvenar = 84.64, Tera = 86, Rift =77.2, Age of Conan= 94.5, Skyforge =85, with the average totaling at 84.3.	Elvenar =70.35, Tera =77.5, Rift =75.6, Age of Conan= 88, Skyforge=86.2, with the average totaling at 76.
ANOVA (one way)	The *f*-ratio value is 1.59. The *p*-value is .211. The result is *not significant* at $p < .05$	The f-ratio value is 0.65669. The p-value is .52219. The result is *not significant* at $p < .05$.	The *f*-ratio value is 1.26189. The *p*-value is .311151. The result is *not significant* at $p < .05$.	The *f*-ratio value was 1.39105. The *p*-value was .265694. The result is *not significant* at $p < .05$.

4.1. Choice Survey Data

The survey used a 5-item Likert type scale with 5 questions**.** Most of the survey takers (64% strongly agreed and 34% agreed) that having choices related to their classwork was beneficial. 73% strongly liked or liked that they had different games to select from. 83% strongly liked or liked that they could select from content, gameplay or both. 32% felt these choices made them less stressed about assignments. 13% felt encouraged to play the game after interacting with contents. 24% felt that choices helped them engage in their learning at their own pace. 23% felt it allowed them to critically examine each choice to see how it fitted with their learning and assessment needs. 8 % did not select these options. Figure 3 summarizes the value of choices. Figure 4 summarizes how choices affected performance.

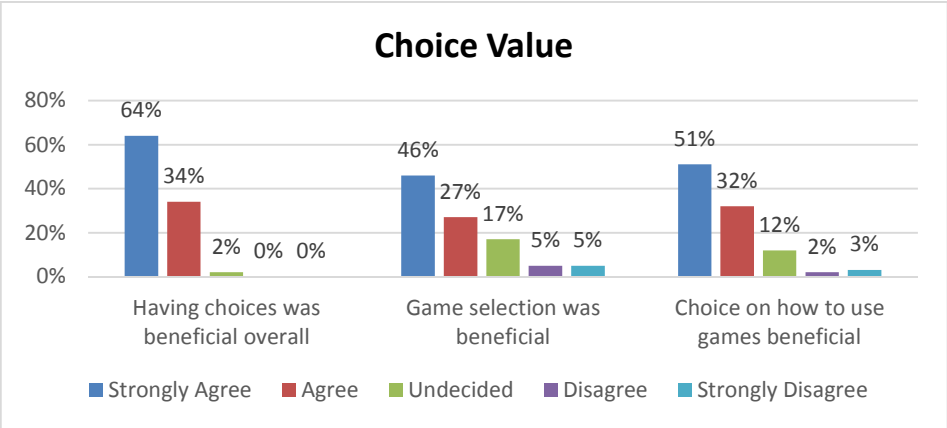

Figure 3: Value of Choices

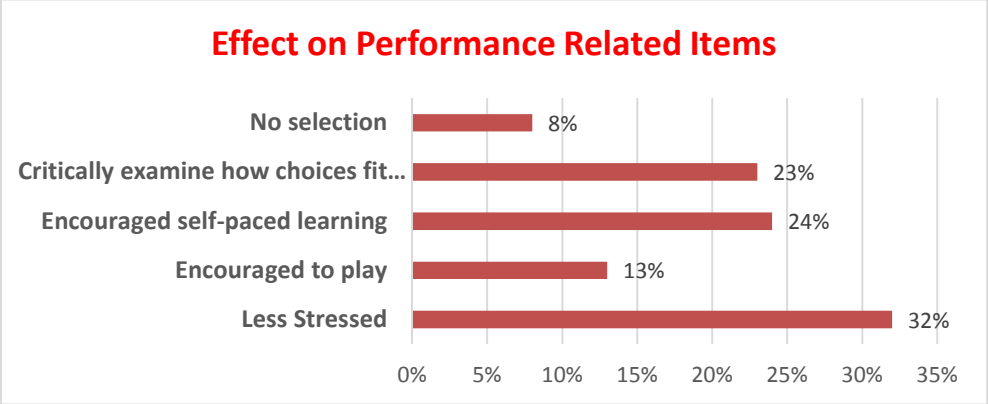

Figure 4: Choices' Effects on Performance

5. Implications, Limitations, Conclusions

Experimental learners outperformed the control groups, irrespective of what game they selected and how they used these games for their learning. This implies that commercial game sub-genres such as MMOGs may be adopted in easy and flexible ways in Higher Education in a multidisciplinary context. Additionally, the data indicates the positive effects of such adoption on learners' performances. This is important, because, technology integration and adoption in classrooms is being pushed by institutions, due to its abilities to transform learning experiences, and possibly enhance performance outcomes (BrckaLorenz, Haeger, Nailos, & Rabourn, 2013; Larsen, Miller & Ribble, 2010). However, many instructors and institutions continue to have issues and concerns with commercial video games as a means of technology integration, due to lack of technical capabilities of instructors, lack of access to resources, unfamiliarity with computer games, lack of support from university administrators, and lack of perceived academic value of commercial video games (Ariffin, 2012; Kenny & McDaniel, 2011). While students may have a greater interest in video games due to the opportunities they provide for innovative thinking, simulating personal experiences and increased engagement due to collaboration, teachers lack interest in such games (Gaudelli & Taylor, 2011).

Additionally, the reason why more teachers have not yet adopted such games into their teaching could be because, "very little has been done to convince teachers that the effort to change their curriculum to integrate video games and other forms of technology is worthy of the effort" (Kenny & McDaniel, 2011, p.197). Thus, there is need to demonstrate to teachers, ways to integrate commercial video games such as MMOGs in classrooms easily and effectively that can take care of their concerns. As explained in a prior section, MMOGs have characteristics that make them a compelling choice.

This study's data strongly suggests that MMOGs can be successfully inserted in existing curriculum, even without learners and teachers having to engage in complex gameplay. The curriculum design allowed learners the flexibility to use the games in terms of what contents to pick, and whether to play the actual game or not. Based on the data, many learners chose to extensively use game contents such as wikis, blogs, videos and website information, while several participants also chose not to play the game, as they found the game related contents to be just as engaging and inductive to learning as game playing. All experimental learners indicated that having flexibility allowed them to be less stressed about coursework, and more engaged with their learning and assessments. This implies that to augment their engagement, leading to higher performance outcomes, learners may not need to worry about learning complex gameplay or spend extra time and efforts to engage in playing, if they can navigate the game contents. Instead, they can allow their

interaction with the game contents to decide whether they have the aptitude and interest to play the game.

Additionally, teachers may not need to make extra efforts to match games to subject matter contents, although it is not implied here that instructional designers or teachers should not take essential care to select MMOGs for the classrooms. Such care is always a prerogative of effective and meaningful curriculum design. However, this study indicates that the efforts required to make such selections and apply them to the curriculum may be far less stringent than feared. Finally, the MMOG game contents are extensive and increasing in complexity, giving birth to ever-expanding databases of information, which makes them ideal tools for multifarious activities (Alqwbani, Zuping, Aqlan, 2014; Greenspan, 2014).

5.1. Theoretical Implications

Other key concepts that may fit this study's findings are choices and autonomy, elaboration of content, and personalized instruction. As indicated by the choice survey data, learners reacted very positively to having choices. According to Deci and Ryan (2012) choice or autonomy could "enhance experiences of competence and self-determination, fostering greater intrinsic motivation" (p. 418), thus leading to "satisfaction of competence needs" (p. 431). Allowing learners to have autonomy in game selection, and how they chose to use these games, emulated a simple to complex activity structure, which was ideal, given the novice gamer status of learners and their technology constraints. This resonates with the concepts of Elaboration Theory (Reigeluth, 1999), because the learners were in control of their learning, used cognitive strategies to build on their learning and critically applied that to their assessments, and used the MMOG contents as analogies to relate to real-world scenarios. Finally, the data supports the principles of Personalized Task Environments, such as personalization of instructional tasks based on learners' interests and prior learning, and availability of subsets of potential tasks for students to select from (Reigeluth, Beatty & Myers, 2017).

5.2. Research Implications

This study investigated if MMOGs, as a commercial game genre (designed for entertainment, not education), could improve learners' performances across disciplines when integrated into the curriculum as engagement tools. Although this study's data provided some positive results and glimpses into this, it is important to continue the research to examine learners' perceptions of what factors within MMOGs contributed to their game selections and performance. In short, more studies need to be done on understanding what led to their selection of certain games and rejection of others, as well as their choice of interacting with contents alone, or play the game alone or do both. This is crucial to the better assessment of the selection process and curriculum design structures for MMOG based learning. Such data may also provide insights as to why many participants in both disciplines selected a specific game, Elvenar, for their learning. This could be important to identify elements within MMOGs that learners find more useful for their educational purposes.

5.3. Limitations

Even though the results were positive and encouraging, this study did have some limitations, leading to future research opportunities. First, it lacked the depth of perception provided by participants as it relied on Quantitative data alone. The positive performance outcomes by the experimental groups provide the base for further qualitative inquiries. Only then can we know how we can better adapt this technology to learner needs. Another limitation is the scope of participants' educational background. Since this study was limited to Associates level in a community college setting, it will be valuable to see if similar results are obtained in different settings such as 4-year

college degrees and Graduate programs. This study was limited to two disciplines, so more information on how MMOGs may influence learning in other disciplines will be needed to further establish the genres' worth. Finally, this study focused on examining one genre of commercial/entertainment games. This was done due to the reasons explained in the Introduction regarding MMOGs, such as high usage, ready availability and relative ease of use as compared to other commercial/entertainment games. However, it may be useful to examine if similar results can be garnered from other commercial and entertainment sub-genres such as single player games and if there could be any differences in the results.

5.4. Conclusion

To conclude, the study's results expanded the scope and structure of the investigation and provided hope that interfacing commercial games such as MMOGs in the curriculum may not be prohibitively complex or difficult. This will be a useful ground upon which to build practitioner guides and curricular platforms that might help technology-phobic teachers, instructional designers, and learners to take that first, tentative step forward into a world where entertainment and education can be harmoniously fused. While the prospects offered by this endeavor are exciting, it is also prudent to be cognizant that the path forward may be challenging, since there is still so much to know about MMOG environments and learners' reactions to them. The initiative of using commercial and entertainment game genres as educational tools facilitates the evolution of technology integration in classrooms, something that researchers and educators have aspired over the years and will continue to do so. This study contributes to this initiative.

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