

**Gamers in the Museum:**  
**A Redesign of Museum Education for the Next Level Visitor**

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Despite overwhelming evidence that video games improve cognitive functions and support skill development, museums have been slow to integrate games into their educational programs and site experiences. Video game players are a large audience that museums need to reach to stay relevant in a fast paced, short-form digital culture. This study looks at the literature surrounding video games and cognition to understand the educational benefits games have. Museum visitor demographic reports are compared to gamer demographics to clarify the overlap in audience. The use of *Minecraft* in education was studied to uncover instances in which principles of constructivist learning theory were demonstrated. A contemporary example of a museum implementing a game in their visitor education was explored to gain insight on applicability. The future of museums in a rapidly digitizing landscape is studied to gain insight on how museums can grow with games. The creation process of an educational experience built in the game *Minecraft* will be documented to provide a foundational basis that can be expanded upon. This study provides suggestions for incorporating games in museum education and engagement.



This thesis is dedicated to my parents, Heather and Patrick, and my brother, Jordon. Thank you always for being my biggest fans.

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## **Gamers in the Museum:**

### **A Redesign of Museum Education for the Next Level Visitor**

Video games are continuing to become a significant and influential aspect of shared common culture. Approximately 227 million Americans play some type of video game.<sup>1</sup> So how can museums connect with this audience? What can be learned from video games and those who play them? How can museums use video games to transform education and engagement and is it worth it to do so?

An average of 79% of Gen Z and Millennials have played a video game in the past 6 months.<sup>2</sup> Over 50% of households with children play video games together.<sup>3</sup> Gaming represents one of the largest forms of entertainment in the world.

With so many young people interested in video games, how can museums use them for learning? It has been shown that video games can be educational and are beneficial to cognitive functions.<sup>4</sup> They help develop the abilities to learn new tasks.<sup>5</sup> Some commercial games have even been found to be successful in brain training activities.<sup>6</sup> How can the cognitive benefits of games be achieved in a museum setting?

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<sup>1</sup>Entertainment Software Association, *2021 Essential Facts about the Video Game Industry*, Washington, DC: Entertainment Software Association, 2021, <https://www.theesa.com/resource/2021-essential-facts-about-the-video-game-industry/>.

<sup>2</sup>Newzoo, *Newzoo Generation Report*, Amsterdam, NL: Newzoo, 2021, <https://newzoo.com/resources/trend-reports/newzoos-generations-report-how-different-generations-engage-with-games>.

<sup>3</sup>Rhys Elliot, “Family Gamers: An Untapped Market for Games Hardware Manufacturers and Subscription Services?” Newzoo, published on September 27, 2018, <https://newzoo.com/resources/blog/family-gamers-an-untapped-market-for-games-hardware-manufacturers-and-subscription-services>.

<sup>4</sup>Gillian Dale and C. Shawn Green, “Associations Between Avid Action and Real-Time Strategy Game Play and Cognitive Performance: a Pilot Study,” *Journal of Cognitive Enhancement* 1, no. 3 (September 2017): 17-19, <https://doi.org/10.1007/s41465-017-0021-8>.

<sup>5</sup>Ru-Yuan Zhang et al, “Action Video Game Play Facilitates ‘Learning to Learn.’” *Communications Biology* 4, no. 1154 (October 2021): 5-6, <https://doi.org/10.1038/s42003-021-02652-7>.

<sup>6</sup>Federica Pallavicini, Ambra Ferrari, and Fabrizia Mantovani, “Video Games for Well-Being: A Systematic Review on the Application of Computer Games for Cognitive and Emotional Training in the Adult Population,” 8, <https://doi.org/10.3389/fpsyg.2018.02127>.

This topic will be explored through a constructivist learning theory lens to highlight constructivist learning principles in video games and museums. Constructivism refers to individuals constructing their knowledge and understanding of the world through experiences and interactions with their environment, emphasizing the role of learners as active participants in the learning process. Both museums and video games demonstrate key elements of constructivist learning theory, such as social collaboration and hands-on experimentation and interaction.<sup>7</sup>

The sandbox video game *Minecraft* is a main focus of this project. Sandbox games open players up to a virtual world where they have the freedom to explore and interact. The term sandbox refers to the concept of giving players a digital “sandbox” or playground to experiment in. Could museums be considered a real life “sandbox?” Do museum and game experiences mirror one another? Younger people are wanting to adopt “participatory culture,” in which they create their own content and share it with the world.<sup>8</sup> Furthermore, Gen Z and Millennials are not growing up to care about museums, nor are they attending at high frequencies.<sup>9</sup> Could introducing games into the museum provide a way to reach these audiences in a way that is meaningful, fun, and educational?

Literature will be collected to help answer these questions. These sources will be divided into categories: Games & Cognition, Video Game Demographics, Museum Visitor Trends,

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<sup>7</sup>Kodi R. Jeffrey-Clay, “Constructivism in Museums: How Museums Create Meaningful Learning Environments,” *The Journal of Museum Education* 23, no 1 (1998): 4-5, <https://www.jstor.org/stable/40479108>; Lalla Merlin, “Gamification and Museums Pt. 2,” <https://blooloop.com/museum/in-depth/gamification-museums-aardman-amnh/>.

<sup>8</sup>Harry Jenkins and Vanessa Bertozzi, “Artistic Expression in the Age of Participatory Culture,” In *Engaging Art: The Next Great Transformation of America’s Cultural Life*, edited by Steven J. Tepper and Bill Ivey (New York: Routledge Publishing, 2008): 171-195, <https://gregsandow.com/BookBlog/YoungCreate.pdf>.

<sup>9</sup>Laura M. Crispin and Molly I. Beck, “Disparities in Museum Attendance among Youth over two Decades: an Empirical Analysis of Who Attends and How Often,” *Arts Education Policy Review* (March 2023), <https://doi.org/10.1080/10632913.2023.2187499>; Colleen Dilenschneider, “Arts & Culture Remain Less Important To Younger Generations (DATA),” *Impacts Experience*, published on July 12, 2017, <https://www.colleendilen.com/2017/07/12/arts-culture-remain-less-important-younger-generations-data/>.

Principles of Constructivism, and Current State. Contemporary cases of *Minecraft* being used educationally will be explored to provide examples of the application of video games in learning settings.

With video games becoming a prevalent piece of contemporary culture, attracting millions of players, museums have an opportunity to tap into this gaming culture and establish meaningful connections with their audiences. Because millions of young people, particularly Gen Z and Millennials, engage with video games and adopt participatory culture, museums must consider the potential of gaming to transform education and engagement. By exploring the cognitive benefits of video games, drawing from constructivist learning theory, and examining sandbox games like *Minecraft*, this study aims to clarify how museums can effectively use video games as 'sandboxes' for immersive, educational experiences, connecting to the preferences of younger audiences while redefining the role of museums in the digital age.

This topic draws from the personal experience of the author. Interest in history and video games grew from playing the real-time strategy game *Age of Empires*. Players assume the roles of historic figures and learn about significant events and cultural heritage through in-game campaigns and missions. The game features an extensive glossary that defines and explains different aspects of the medieval era and it can be viewed at almost any point of the game. Playing this game proved to be a pivotal moment that fostered a lifelong affinity for history and gaming, and provides the inspiration for this project.



**AR** - Augmented reality. An interactive experience combining reality and computer-generated assets.

**Constructivism/Constructivist Learning Theory** - individuals are active learners and gain knowledge through experiences and interactions with their environment and reflecting on new ideas within the context of pre-existing knowledge structures.

**FPS** - First-person shooter.

**Gamer** - An individual who plays video games. Also referred to as players.

**Gaming culture** - Global media subculture formed by video game players and hobbyists with a significant influence on popular culture due to games becoming more complex and popular.

**Information and Communication Technologies** - digital tools and systems that make it easier to communicate, connect with others, and access knowledge and resources.

**Minecraft** - 3D sandbox game available on computer, console, and mobile.

**Mob** - AI (artificially intelligent) controlled mobile entity resembling a living creature.

**RPG** - Role-playing game.

**RTS** - Real-time strategy.

**Sandbox games** - games with elements that give players a great degree of creativity to explore, typically lack a predetermined objective, or players set goals for themselves.

**Social constructivism** - development is social based and knowledge is built through interaction.

**VR** - Virtual reality. An immersive, simulated experience inside a virtual world.

**Video game** - A video game, or digital game, is an interactive form of entertainment that involves player participation and engagement with a virtual world or simulated environment.

Research on this topic initially began by searching for articles on the effects video games have on the brain. This led to a large body of research on the benefits video games can have on cognition and learning. Reading about these benefits highlighted the possibility of using games for education.

Video games may be good for the brain, but how does this relate to museums? Literature about the habits and behaviors of young museum audiences, i.e., Gen Z and Millennials, were collected to determine any discrepancies. It was shown that these groups lack repeat visitation, or visitation appropriate to their generational size.

Once these trends were uncovered, they were compared with the demographics of video game players. Gen Z and Millennials make up the two largest gaming groups. There is an audience overlap between museum visitors and video game players.

The constructivist learning theory in relation to museums and the video game *Minecraft* was studied. If viewed through a constructivist lens, game and museum experiences mirror one another, demonstrating an opportunity for the integration of the two.

The Current State subcategory provides examples of game implementation in a museum setting. It also explores a contemporary museum that could serve as an appropriate site for utilizing a video game for education.

### *2.1 Games and Cognition*

There has been a steadily growing body of research about video games, especially regarding their impact on our brains and behaviors. In the past two decades, there has been a

growing emphasis on measuring the cognitive effects games have on the brain, and how this can be harnessed for positive purposes. Studying these cognitive effects is important in determining how games can be used for education or interpretation. Seeing how people's behaviors are influenced by games can be significant in shaping museum educational experiences, and guiding how people move through a space. The current body of research demonstrates that video game training can increase performance in not only the game itself but in a broad array of cognitive tasks.

A 2017 study done by Gillian Dale and C. Shawn Green aimed to replicate previous findings to show the differences in cognition between those who regularly play video games and those who do not. They found that recent research focuses on specific genres of games and their impact on cognitive functions. This differs from previous years in which studies on games focus more so on either just one specific game title or focus on all games in general. For their study, Dale and Green instead focus primarily on the action genre and the real-time strategy genre. They assert that games in the same genre often share central characteristics: content, mechanics, dynamics, and interactions. These core elements aid in determining the “cognitive demand” that is put on players. These cognitive demands seem to be the likely influence behind the improvements in cognition through gaming. They focused their research on those who play real-time strategy (RTS) games, those who play action video games, and those who play across multiple genres. They compared the gamers' results to the results of those who do not regularly play video games.<sup>10</sup>

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<sup>10</sup>Gillian Dale and C. Shawn Green, “Associations Between Avid Action and Real-Time Strategy Game Play and Cognitive Performance: a Pilot Study,” *Journal of Cognitive Enhancement* 1, no. 3 (September 2017), <https://doi.org/10.1007/s41465-017-0021-8>.

Action games are fast-paced and require players to pay attention to multiple areas across a large visual field. Previous studies have already shown cognitive improvement from action games in areas such as visual spatial attention, object tracking, motor coordination, executive control, and cognitive flexibility. Frequent action players have been shown to score better than non-action players in areas such as processing speed, temporal attention, visual searching, multiple object tracking, task switching, peripheral vision, contrast sensitivity, and mental rotation. It has been seen that while action games used to be one of the few genres that require fast processing, visual-spatial abilities, and motor coordination, many new genres across the field are now implementing these cognitive demands.<sup>11</sup>

One such genre that has changed is the strategy game genre. About twenty years ago, strategy games were mostly defined by their turn-based functionality, meaning players had as much time as they needed to make a move or take an action. However, with the advent of real-time functionality and online area games, many strategy games are now incorporating action genre cognitive demands. Dale and Green theorize that playing real-time strategy games may improve similar cognitive functions as action games.<sup>12</sup>

Based on their research, they concluded that their results align with previous findings. They found that action gamers are significantly faster than non-gamers in terms of reaction speed, task switching, and variables of attention. Not only was their task switching time quicker but players were shown to be able to do a “cognitive reset” during the switch. Dale and Green also found that action gamers are superior at tracking multiple objects. Despite them being

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<sup>11</sup>Dale and Green, “Associations Between Avid Action and Real-Time Strategy Game Play and Cognitive Performance,” 2.

<sup>12</sup>Dale and Green, “Associations Between Avid Action and Real-Time Strategy Game Play and Cognitive Performance,” 2.

quicker, action gamers were no more accurate than non-gamers. Dale and Green suggest that this indicates a lack of impulsivity in action gamers. Similar results were found with the strategy gamers. While they showed a slightly smaller processing speed than action gamers, they showed more cognitive improvements over non-gamers. Dale and Green suggest that due to the narrower focus on strategy games, there are differences between strategy gamers and action gamers. Lastly, Dale and Green found that the performance of those who played across genres fell in between the scores of the action and strategy gamers. This suggests that even those who just generally game can show cognitive improvements and skill development.<sup>13</sup>

In 2022, Nikodem Hryniewicz, Paulina Lewandowska, et. al., took some of these concepts even further. While it has been shown that there are associations between video games and cognition and that video game players outperform those who do not regularly play games in perceptual and attentional activities, it was unclear how brain structure and characteristics play a role in gaining cognitive-motor skills through games. The researchers highlight a few prior studies that show that video game players show more gray matter volume in the lenticular nucleus. These reports also exhibit gamers having greater white matter integrity of the visual and motor structures and increased connectivity between the frontal and regions involving touch and perception. Despite these findings, the available work fails to highlight if there is any connection between playing video games and enhanced cognitive ability. This oversight suggests that there

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<sup>13</sup>Gillian Dale and C. Shawn Green, "Associations Between Avid Action and Real-Time Strategy Game Play and Cognitive Performance: a Pilot Study," *Journal of Cognitive Enhancement* 1, no. 3 (September 2017): 17-19, <https://doi.org/10.1007/s41465-017-0021-8>.

is no connection between gaming and brain structure. To prove this connection, an experiment was conducted to verify connections between cognitive predisposition and video game training.<sup>14</sup>

Because video games require practice to learn specific skills, force quick decisions, and engage with several cognitive functions, they can be considered complex tasks. A real-time strategy game, *Starcraft II*, was used because it “is considered a great tool to study complex skill acquisition.” Twenty-three participants were chosen based on their responses to a survey. Individuals with little to no previous experience with real-time strategy games were chosen. Each participant underwent brain scans and cognitive assessments before training commenced and over the 60-hour training period. For their study, the researchers focused on the pre-training session and the first 30 hours of training.<sup>15</sup>

The results showed the importance of brain structure and characteristics in the effectiveness of complex task training and the acquisition of new skills. It was found that the structure of white matter in the brain plays a role in being predisposed to acquiring video game skills. They found that white matter regions are associated with the indicators tied to psychomotor functioning, set-shifting ability, and visually guided behaviors and decisions. The researchers also note that similar studies done previously had been completed using much simpler games than *Starcraft II*, but the patterns discovered are the same. Overall, their results

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<sup>14</sup>Paulina Lewandowska et al, “Association Between Real-Time Strategy Video Game Learning Outcomes and Pre-Training Brain White Matter Structure: Preliminary Study, *Scientific Reports* 12, no. 20741 (December 2022), <https://doi.org/10.1038/s41598-022-25099-0>.

<sup>15</sup>Paulina Lewandowska et al, “Association Between Real-Time Strategy Video Game Learning Outcomes and Pre-Training Brain White Matter Structure,” 2-3.

indicate that those with particular neural predispositions perform better in complex task-learning processes, like playing video games.<sup>16</sup>

A study done by Ru-Yuan Zhang, Adrien Chopin, Kengo Shibata, et. al., in 2021 aimed to further understand how the mechanisms underlying how learning generalizes from trained to untrained. Some mechanisms that may promote cognitive development have been previously proposed. One mechanism is “learning to learn.” Learning to learn is when the skills and information gained from a task allow individuals to learn other new tasks faster. Learning to learn is a possible way through which video games can produce broad generalization of skills. Action game training can enhance cognition by increasing players’ abilities to learn new tasks by developing the ability to quickly identify things relevant to tasks.

Despite the literature showing these cognitive developments from game training, there is little on whether this fast learning extends into other domains other than the perceptual domain. This study seeks to test whether experience in action video games can improve one’s ability to learn new tasks. Testing was also conducted to see how video game training can result in “learning to learn” in both low-level perceptual tasks, and higher-level cognitive tasks.<sup>17</sup>

To measure this, two specific cognitive learning tasks were chosen to test: orientation and working memory. Two test groups were studied and compared. Participants’ gaming skills were measured by evaluating their abilities over several points of the testing period. It was confirmed that playing action video games increases the learning rate on new tasks in both low-level and high-level tasks. Results were consistent across both testing groups. However, there was no

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<sup>16</sup>Paulina Lewandowska et al, “Association Between Real-Time Strategy Video Game Learning Outcomes and Pre-Training Brain White Matter Structure: Preliminary Study, *Scientific Reports* 12, no. 20741 (December 2022): 6-9, <https://doi.org/10.1038/s41598-022-25099-0>.

<sup>17</sup>Ru-Yuan Zhang et al, “Action Video Game Play Facilitates ‘Learning to Learn.’” *Communications Biology* 4, no. 1154 (October 2021): 2-3, <https://doi.org/10.1038/s42003-021-02652-7>.

consistent data on the roles of motivation, attentional control, and flow state. However, this study demonstrates that playing video games can increase the capacity to learn new tasks.<sup>18</sup>

A review done in 2018 by Federica Pallavicini, Ambra Ferrari, and Fabrizia Mantovani aims to present “research evidences” on the impact of video games on cognitive and emotional skills. A great deal of literature exists about the cognitive developments from video games, but there is much less studying the emotional improvements games can produce.<sup>19</sup>

Researchers studied and demonstrated the benefits video games can have on our cognition for the first time in 1987. The 1998 game *Space Fortress*, was the first non-commercial game created by psychologists as a tool for research and training. This game was a success, so much so that the Israeli Air Force adopted it for use in their training programs. Since then, it is evident that more games are being created to motivate change in patterns of behavior. These games are often referred to as ‘serious games’ because they serve serious purposes.<sup>20</sup>

They performed an analysis on previous studies from 2012 to 2017 and used these to identify research evidences about the impact on cognitive and emotional skills of video games training in the adult population.” Their research showed an interesting trend. They found that commercial games were as efficient as *ad-hoc* noncommercial games (games created by researchers to measure data), and brain-training games in cognitive skill learning. For example, *Portal 2* was found to be more effective at brain training than *Luminosity*, a game program

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<sup>18</sup>Ru-Yuan Zhang et al, “Action Video Game Play Facilitates ‘Learning to Learn.’” *Communications Biology* 4, no. 1154 (October 2021): 5-6, <https://doi.org/10.1038/s42003-021-02652-7>.

<sup>19</sup>Federica Pallavicini, Ambra Ferrari, and Fabrizia Mantovani, “Video Games for Well-Being: A Systematic Review on the Application of Computer Games for Cognitive and Emotional Training in the Adult Population,” *Frontiers in Psychology* 9, (November 2018): 2, <https://doi.org/10.3389/fpsyg.2018.02127>.

<sup>20</sup>Federica Pallavicini, Ambra Ferrari, and Fabrizia Mantovani, “Video Games for Well-Being,” 2-3.



specifically designed for brain training. They postulate that this result can open opportunities for using commercial games for brain training in adults.<sup>21</sup>

A recent study published in 2023 by Daniel Camuñas-García, María Pilar Cáceres-Reche, and María de la Encarnación Cambil-Hernández used many of the aforementioned concepts and data to determine the effectiveness of using video games to maximize engagement with cultural heritage. They identify the need to educate young people about cultural heritage, and increase their involvement, especially as heritage is continuously being digitized. They assert that it is vital for individuals aged 6-16 to learn about their cultural heritage, as it helps one understand their identity, values, and place in society. Based on their results, they developed a framework for designing and evaluating games involving cultural heritage. They highlighted ten game design features and organized them under the three domains of the cognitive learning theory, cognitive, emotional, and behavioral. This demonstrated that particular game elements are present in two or three learning dimensions. They also found “that experts and students were in agreement about what game characteristics would be the most engaging for young players.”<sup>22</sup> It can be gathered that it is not enough to simply “know” cultural heritage, but that one needs to care about it and be motivated to change their behaviors or take action.

It would be disingenuous to ignore scholarship about the negative effects video games can have on cognition. An opposing viewpoint was raised in a literary review done in 2022 by Claudio Rojas-Jara, Roberto Polanco-Carrasco, et.al. Their goal was to characterize video game

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<sup>21</sup>Federica Pallavicini, Ambra Ferrari, and Fabrizia Mantovani, “Video Games for Well-Being: A Systematic Review on the Application of Computer Games for Cognitive and Emotional Training in the Adult Population,” 8, <https://doi.org/10.3389/fpsyg.2018.02127>.

<sup>22</sup>Daniel Camuñas-García, María Pilar Cáceres-Reche, and María de la Encarnación Cambil-Hernández, "Maximizing Engagement with Cultural Heritage through Video Games," *Sustainability* 15, no. 3 (January 2023): 1-12, <https://doi.org/10.3390/su15032350>

use disorder (VGD), a condition based on nine criteria from the DSM-V, in adolescents. They also sought to identify the specifics of those who present it, plus its effect on the brain. They found changes in the prefrontal cortex, which may provide a link to impulsivity. They also found evidence to support the claim that those with VGD may show more difficulty in emotional regulation. It is important to consider these findings, especially when creating programs or interactives that utilize games for adolescents.<sup>23</sup>

## *2.2 Video Game Demographics*

Data about gamer demographics was collected and studied to understand the trends, opinions, and behaviors of gamers.

Newzoo, the leader in gamer and video game data, surveyed 72,000 video game players from 33 countries in 2021. 81% of Gen Z and 77% of Millennials have played video games in the past six months. While older generations do engage with video games, they use other forms of entertainment more often. 75% of Gen Z and 71% of Millennials also watch some type of gaming-related content, such as Twitch streams, gameplay compilations, and, tutorials. Interestingly, 70% of Gen Z and 63% of Millennials want to see more “hanging out” in video games in the future.<sup>24</sup>

Another study conducted by Newzoo focused on families. They defined “family gamers” as a household in which adults and children play video games together. 68% of households with

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<sup>23</sup>Claudio Rojas-Jara et al, “Game (not) Over: A Systematic Review of Video Game Disorder in Adolescents,” *Revista Colombiana de Psicología* 31, no 2 (July 2022), <https://doi.org/10.15446/rcp.v31n2.90741>.

<sup>24</sup>Newzoo, *Newzoo Generation Report*, Amsterdam, NL: Newzoo, 2021, <https://newzoo.com/resources/trend-reports/newzoos-generations-report-how-different-generations-engage-with-games>.

children play video games together. They are also more likely to play diverse game genres, presenting a wide interest range.<sup>25</sup>

A 2018 study conducted by the Entertainment Software Association found that around 227 million Americans are gamers. 55% of players identify as male, and 45% identify as female. Respondents were asked about the usage of video games during the pandemic lockdown and their impact on virtual learning. 59% of parents said their children played educational games during this time, and 63% of them found them “very” or “extremely successful.” 66% of parents concluded that video games made the transition to virtual learning easier. Players hold positive views of video games. They believe that video games can inspire, and foster collaboration. 75% of gamers think that game experiences can improve cognition and 80% believe games can be educational.<sup>26</sup>

### *2.3 Museum Visitor Trends*

Studies about museum visitor demographics have been collected and analyzed to understand who is going to museums and how often. Visitor visitation trends and behaviors have also been studied to clarify how people are interacting with museums.

Betty Ferrell and Maria Medveda from the American Alliance of Museums studied the future of museum demographics. It was found that younger generations, defined as Gen Z and Millennials, are looking for new interactives that engage them in a way that is familiar to them.

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<sup>25</sup>Rhys Elliot, “Family Gamers: An Untapped Market for Games Hardware Manufacturers and Subscription Services?” Newzoo, published on September 27, 2018, <https://newzoo.com/resources/blog/family-gamers-an-untapped-market-for-games-hardware-manufacturers-and-subscription-services>.

<sup>26</sup>Entertainment Software Association, *2021 Essential Facts about the Video Game Industry*, Washington, DC: Entertainment Software Association, 2021, <https://www.theesa.com/resource/2021-essential-facts-about-the-video-game-industry/>.

Oftentimes, this translates into digital interactives. It is important to note that these generations do not see digital interactives as novel or cutting-edge, they see them as a way of life. They expect museums to have these features because many other areas of their lives are already digital.<sup>27</sup>

A study conducted by Laura Crispin and Laura Beck discovered the disparities in museum attendance amongst adolescents. Museum attendance as a child correlates to increased museum visitation as an adult. However, based on discrepancies amongst previous museum visitation surveys, around half of children and teenagers are actually not attending museums at any frequency. Youth in rural areas are less likely to visit museums, compared to those who live in urban areas. While a sizable amount of children are attending museums, they are not visiting and interacting at high frequencies.<sup>28</sup>

Based on a survey by Impact's Experience, Millennials are one of the largest museum visitor demographics. However, despite their high visitation, it is still not proportional to the large generational size. It is suggested that Gen Z and Millennials are not "aging into caring" about museums and the arts, contradicting previous thoughts. Engaging Millennials in ways that encourage higher visitation rates requires shifts in organization planning. It is not enough to

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<sup>27</sup>Betty Farrell et al, "Demographic Transformation and the Future of Museums," Center for the Future of Museums, Washington, DC: AAM Press, 2010, <https://www.aam-us.org/wp-content/uploads/2017/12/Demographic-Change-and-the-Future-of-Museums.pdf>.

<sup>28</sup>Laura M. Crispin and Molly I. Beck, "Disparities in Museum Attendance among Youth over two Decades: an Empirical Analysis of Who Attends and How Often," *Arts Education Policy Review* (March 2023), <https://doi.org/10.1080/10632913.2023.2187499>.

simply add new programs. This generation needs to be reached and connected to in ways that require museums to conceive of new methods of engagement.<sup>29</sup>

Many young Americans are adopting a “participatory culture.” This is defined as a culture in which private individuals are creating and contributing their content. Gen Z and Millennials are not disconnecting with culture, they are connecting in new ways. Art and culture are no longer just staples of a museum, they are constantly being weaved into daily life. Value from this created content comes from other members of the community. This highlights the importance of directly involving visitors.<sup>30</sup> It is worth connecting this to the participatory nature of gaming communities. Many game publishers accept and encourage their players to use their assets to create things in their games. Bethesda Softworks is an example of a game publisher that utilizes their fanbases’ creations. Following the release of their 2011 hit game *Skyrim*, Bethesda released an official modification kit, called The Creation Kit. This toolkit allows players to create mods that can add original characters, quests, in-game assets, etc., to the game. This kit is free, allowing for wide accessibility. Each month, Bethesda highlights many community mods on their Creation Club website to increase the visibility of user creations.<sup>31</sup> Overall, cultural participation can help develop the skills and knowledge necessary to effectively participate in new and developing cultural practices.

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<sup>29</sup>Colleen Dilenschneider, “Arts & Culture Remain Less Important To Younger Generations (DATA),” Impacts Experience, published on July 12, 2017, <https://www.colleendilen.com/2017/07/12/arts-culture-remain-less-important-younger-generations-data/>.

<sup>30</sup>Harry Jenkins and Vanessa Bertozzi, “Artistic Expression in the Age of Participatory Culture,” In *Engaging Art: The Next Great Transformation of America’s Cultural Life*, edited by Steven J. Tepper and Bill Ivey (New York: Routledge Publishing, 2008): 171-195, <https://gregsandow.com/BookBlog/YoungCreate.pdf>.

<sup>31</sup>“Creation Club,” Bethesda Softworks, accessed April 2023, <https://creationclub.bethesda.net/en>.

## 2.4 Principles of Constructivism

Constructivism is a learning theory that suggests that people actively build their knowledge and understanding of the world through experience and interaction. The constructivist theory emphasizes active learning, social collaboration, and scaffolding. Scaffolding is a teaching strategy in which learners are given frameworks of guidance as they engage in a new task or acquire a new skill.

Psychologist Jean Piaget laid the foundations for the constructivist learning theory. He believed that cognition is the constant, active process of interaction between an individual and their environment. He argued that people affect their environment as much as their environment affects them.<sup>32</sup>

Lev Vygotsky, another psychologist, took some of Piaget's ideas on learning even further. Vygotsky believed that higher-level cognitive processes are the vital foundations for things such as logical thought, comprehension, and generalization. He agreed that learning is an active process that individuals are involved in. Vygotsky stressed the importance of social interaction in learning. He also put forth the claim that learners start with an existing structure of knowledge, which is grown and altered through the learning process.<sup>33</sup>

The latter two sentiments inspired Vygotsky's concept of the Zone of Proximal Development (ZPD). Vygotsky held the belief that education should lead learners, but only be slightly ahead of their current level of understanding. This space between the current level and the potential level is the zone of development. Vygotsky highlights the importance of the

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<sup>32</sup>Norman Sprinthall and Richard C. Sprinthall, *Educational Psychology: A Developmental Approach* (New York: McGraw-Hill Education, 1997), 112.

<sup>33</sup>Norman Sprinthall and Richard C. Sprinthall, *Educational Psychology: A Developmental Approach*, 132.

educator in this process. Educators participate in scaffolding by presenting some type of challenge or something to solve. They provide extra support if necessary, but allow learners to freely use their active problem-solving skills to work things out on their own. Learners are not simply given insights by their educators; they make insights based on their own experiences.<sup>34</sup>

The theory of ZPD creates a framework for intrinsic motivation for learning. This motivation is described as enjoyment that results from learning and problem-solving. This differs from extrinsic motivation, in which learners are motivated to learn in order to receive a reward. Vygotsky understood the affective aspect of learning and believed that learners would feel positive after making a breakthrough in their knowledge.

Vygotsky put great value on the social aspect of learning. He defined the term “more-knowledgeable other” as an individual who has a higher level of understanding or knowledge than the learner. Typically, this individual is a teacher or parent, but it can also be a more advanced peer or fellow student. Through collaboration with other learners and more-knowledgeable others, meaning can be made and new levels of understanding can be achieved.<sup>35</sup>

*Minecraft* has been used often in educational settings. The following studies demonstrate the common themes and findings relating to constructivist learning principles and how they emerge through *Minecraft* learning scenarios. *Minecraft* was chosen as the game of focus due to its popularity and the range of possibilities it presents for education.

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<sup>34</sup>Norman Sprinthall and Richard C. Sprinthall, *Educational Psychology: A Developmental Approach*, 134.

<sup>35</sup>Norman Sprinthall and Richard C. Sprinthall, *Educational Psychology: A Developmental Approach*, 134.

Case studies done by Nolene Callaghan highlight how technology and gaming culture is changing education. Her focus is on how *Minecraft Education* can enhance learning processes.<sup>36</sup> *Minecraft Education* retains many of the core gameplay mechanics of the original version, and adds “features built specifically for learning environments to support collaboration, assessment, coding, and more.” Educators can also oversee student accounts and create lessons.<sup>37</sup>

168 students used *Minecraft Education* with their educators to achieve learning goals. The students were surveyed and 68% reported that they had played *Minecraft* previously. 72% of students believed in the educational benefits of *Minecraft Education*.<sup>38</sup> It is significant to note that more than half of the students had played *Minecraft*. They had a foundation of knowledge that they could now build on through the prepared lessons.

Students were provided with instructions and scaffolds before they began building, and were encouraged to communicate and freely create. This social aspect of learning was one of the main focuses looked at in this study. Callaghan notes that games can promote learning due to players being able to share information and learn from one another. Students shared their expertise, and the most skilled players led the groups. It was shown that genuine collaborative environments emerged and that with more communication, learning goals were achieved better.<sup>39</sup>

The role of the educator proved pivotal. Their direct involvement was shown to increase student engagement and motivation. Educators can join students in the building process. Students were eager to show off their creations, and would gladly take feedback and make any necessary

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<sup>36</sup>Nolene Callaghan, “Investigating the Role of *Minecraft* in Educational Learning Environments,” *Educational Media International* 53, no 4 (November 2016): 245, <https://doi.org/10.1080/09523987.2016.1254877>.

<sup>37</sup>“Minecraft Education,” Mojang Studios, accessed July 1, 2023, <https://education.minecraft.net/en-us>.

<sup>38</sup>Nolene Callaghan, “Investigating the Role of *Minecraft* in Educational Learning Environments,” 251.

<sup>39</sup>Nolene Callaghan, “Investigating the Role of *Minecraft* in Educational Learning Environments,” 247-252.



changes.<sup>40</sup> This demonstrates successful scaffolding and the importance of the educator facilitating an experience where students are free to learn from and with one another.

Research conducted by Jordan Licenberg and Rebecca Eynon sought to see how educators shape student agency in the classroom use of *Minecraft*.

They define agency in games as making choices and taking action. They argue that rules and restrictions in games create spaces where certain actions that would otherwise be meaningless become meaningful. The game space and the player do not exist independently from one another instead they emerge together through play. Going further, when players continuously defy the rules, or create and perform their own new set of rules the possibilities for new games and forms of engagement emerge.<sup>41</sup>

Next, the researchers sought to demonstrate how student agency relates to education. They bring forth the concept of “democratic subjectivity.” This is essentially the way one comes into the world’s social fabric through the acknowledgment of others and their responses to the individual’s actions.<sup>42</sup> A vital responsibility an educator has is to create and facilitate a space where this freedom and individuality can blossom.<sup>43</sup>

It was shown that immersion plays a crucial role in creating a successful space that encourages democratic subjectivity. Students do not view the lesson as learning, they see it as an

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<sup>40</sup>Nolene Callaghan, “Investigating the Role of *Minecraft* in Educational Learning Environments,” *Educational Media International* 53, no 4 (November 2016): 255-256, <https://doi.org/10.1080/09523987.2016.1254877>.

<sup>41</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Worldly Spaces: The Role of the Educator in Shaping Student Agency in *Minecraft*,” *Review of Education, Pedagogy, and Cultural Studies* 45, no 2 (October, 2021): 195, <https://doi.org/10.1080/10714413.2021.1970465>.

<sup>42</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Worldly Spaces,” 196-197.

<sup>43</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Wordly Spaces,” 198-199.

enjoyable experience in a game that is culturally accessible to them. Many students showed great investment in their builds, going as far as continuing to work on them at home.<sup>44</sup>

It was also shown that this method of education promotes communication among students. Students look for new and fun ways to socialize. *Minecraft* provided a platform for students to engage with each other in a way they felt was meaningful and enjoyable.<sup>45</sup>

Narration was another game element that proved to be significant. Having some type of narrative structure (lessons, student-led activities) helps students connect their world and the meaning of the activity.<sup>46</sup>

Another aim was for educators to create spaces that encouraged students to experience and learn digital citizenship, consequences, and empathy. The concept of “visiting,” thinking about how you would feel and what you would do in someone else’s position, was introduced. While *Minecraft* worlds can encourage visiting, “challenging” prompts from the educator are necessary to facilitate critical engagement and empathy. The researchers state that “in their capacity as game designers and architects, educators influence whether voices and subjectivities will be silenced or empowered.”<sup>47</sup>

Many of the aforementioned concepts were also demonstrated in a study done by Simon Bourdeau, Thibaut Coulon, and Marie-Claude Petit. The implementation of information and communication technologies in education has been slow. *Minecraft Education* was used to teach a project management program called Scrum to university students. Simulation-based learning

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<sup>44</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Worldly Spaces: The Role of the Educator in Shaping Student Agency in *Minecraft*,” *Review of Education, Pedagogy, and Cultural Studies* 45, no 2 (October, 2021): 204-205, <https://doi.org/10.1080/10714413.2021.1970465>.

<sup>45</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Wordly Spaces,” 205.

<sup>46</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Wordly Spaces,” 205.

<sup>47</sup>Jordan Licenberg and Rebecca Eynon, “Crafting Wordly Spaces,” 206-208.

like this is a method of active learning, which can lead to increased motivation. Going further, games and play positively influence learning.<sup>48</sup>

Several relevant findings were uncovered. It was observed that the players felt confident to make decisions, take action, and even make mistakes. The educator plays an important role in this feeling of safety. Educators must create an environment where players can try things and make connections. This relates to the social nature of such a space. Players worked in small teams and were given pre-determined guidelines, and then were encouraged to collaborate and create.<sup>49</sup>

These findings highlight some of the elements of constructivism and demonstrate how games can be used to facilitate learning using this theory. Building off of this, there is a great deal of literature about constructivism in museums. The following helps highlight the similarities between constructivist learning theory in museums and video games.

Educator Kodi Jeffrey-Clay asserts that museums could be an appropriate setting for constructivist learning theory. Museums are multi-sensory sites that offer rich experiences. These experiences could lead to a change in opinions and behaviors. Visitors also have the opportunity to be in contact with a large variety of objects and people. Museums can work to connect their activities and exhibits to themes that are meaningful and relevant to visitors. If these themes

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<sup>48</sup>Simon Bourdeau, Thibaut Coulon, and Marie-Claude Petit, "Simulation-Based Training via a 'Readymade' Virtual World Platform: Teaching and Learning With *Minecraft* Education," *IT Professional* 23, no 2 (March 2021): 33-34, <https://doi.org/10.1109/MITP.2021.3062935>.

<sup>49</sup>Simon Bourdeau, Thibaut Coulon, and Marie-Claude Petit, "Simulation-Based Training via a 'Readymade' Virtual World Platform," 35-36.

resonate with existing knowledge structures, this can aid with further learning and comprehension.<sup>50</sup>

The social nature of museums is greatly significant. This relates to the social aspects of learning. Scaffolding techniques can work well in a museum setting. For example, knowledgeable group members can assist less knowledgeable members through questions, prompts, etc. Educators leading tour groups can also provide scaffolding by giving visitors supplemental information on which they can base new knowledge. The personal context that visitors use in these situations includes their prior knowledge and experiences.<sup>51</sup>

Overall, museums should give visitors experiences that match whatever it is they are aiming to teach. This can be a challenge when considering what prior knowledge visitors come to the museum with. That is why it is important to build bridges and connect to their current structures of knowledge and points of interest.<sup>52</sup>

Professor George Hein investigates the links between constructivism and meaning making. He defines meaning making as the way individuals interpret information through their senses, and create pedagogically significant interpretations.<sup>53</sup> Hein asserts that learning inherently is making meaning.<sup>54</sup> He argues that in museums, visitors do not necessarily learn what is intended by the exhibit or activity. Instead, they make meaning through new experiences

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<sup>50</sup>Kodi R. Jeffrey-Clay, "Constructivism in Museums: How Museums Create Meaningful Learning Environments," *The Journal of Museum Education* 23, no 1 (1998): 4-5, <https://www.jstor.org/stable/40479108>.

<sup>51</sup>Kodi R. Jeffrey-Clay, "Constructivism in Museums, 6.

<sup>52</sup>Kodi R. Jeffrey-Clay, "Constructivism in Museums: How Museums Create Meaningful Learning Environments," *The Journal of Museum Education* 23, no 1 (1998): 7, <https://www.jstor.org/stable/40479108>.

<sup>53</sup>George E. Hein, "Is Meaning Making Constructivism? Is Constructivism Meaning Making?" *The Exhibitionist* 18, no 2 (Fall 1999): 1, [http://www.george-hein.com/downloads/Hein\\_isMeaningMaking.pdf](http://www.george-hein.com/downloads/Hein_isMeaningMaking.pdf).

<sup>54</sup>George E. Hein, "Is Meaning Making Constructivism?" 2.

that are combined with their existing frameworks of understanding. Overall, constructivism recognizes the importance of meaning making.<sup>55</sup>

Consistent with Jeffrey-Clay, Hein argues for the importance of understanding museum visitors. It is crucial to have some understanding of the knowledge, interests, and experiences that visitors bring with them to a museum. All this prior knowledge influences the meanings made. Museums that use constructivist theory create opportunities for visitors to expand their perspective, make connections, and increase their scope of understanding. They also provide a place for visitors to validate or express their interpretations. In short, constructivism elevates meaning making to a central role in the overall learning process.<sup>56</sup>

## 2.5 Current State

Some museums are already implementing games into their learning experiences. For example, the American Museum of Natural History in New York has utilized several games for visitor education and engagement.<sup>57</sup>

During an NYC Museum Educators Roundtable session, video game developer Nick Fortugno and digital strategist Barry Joseph spoke about their experiences creating games for the American Museum of Natural History. They spoke about the application of a game they had made: MicroRangers.<sup>58</sup>

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<sup>55</sup>George E. Hein, “Is Meaning Making Constructivism? Is Constructivism Meaning Making?” *The Exhibitionist* 18, no 2 (Fall 1999): 2-3,

[http://www.george-hein.com/downloads/Hein\\_isMeaningMaking.pdf](http://www.george-hein.com/downloads/Hein_isMeaningMaking.pdf).

<sup>56</sup>George E. Hein, “Is Meaning Making Constructivism?” 4-5.

<sup>57</sup>“Games,” Ology, American Museum of Natural History, accessed April 19, 2023, <https://www.amnh.org/explore/ology/games>.

<sup>58</sup>Nick Fortugna and Barry Joseph, “Games and Education Virtual Talk” (NYCMER Roundtable, March 8, 2023, virtual).

MicroRangers is a mobile app game using augmented reality technology that “shrinks you down to microscopic size and sends you into exhibits to combat threats to biodiversity.” Visitors create digital avatars and receive a collector coin at the museum that allows for connectivity with objects across the museum’s Hall of Biodiversity. Visitors are engaged in an augmented reality experience featuring characters that give them “quests” that focus on real-world issues surrounding biodiversity.<sup>59</sup>

It was recognized that “young people growing up in the digital age have new ways of learning,” and that game design can be a great way to teach. Joseph stated that “the game itself and the game process has become sophisticated enough to be able to teach the player how to play within the world of the game itself. And, so, young people are in these learning systems where failure is not bad: it’s how you learn.”<sup>60</sup> A learning system that does not punish users for failure and instead encourages them to learn from their mistakes and try again can be a vital tool in museum education. Joseph asserts that “games are able to create zones of proximal learning...It’s not too hard that you feel overwhelmed; it’s not too easy that you feel bored, but it keeps you in that zone between, where you’re constantly engaged by learning.”<sup>61</sup> Games are already using theories of education, so why couldn’t they be implemented in museums that are already using theories of social constructivism? Supporting young learners and recognizing that they have new ways of learning is greatly beneficial to museums working on implementing game design in their visitor experiences.

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<sup>59</sup>“Microrangers Learning Guide,” American Museum of Natural History, 2015, [https://www.amnh.org/content/download/112722/2012083/file/Microrangers\\_learning\\_guide\\_3.21.16.pdf](https://www.amnh.org/content/download/112722/2012083/file/Microrangers_learning_guide_3.21.16.pdf).

<sup>60</sup>Lalla Merlin, “Gamification and Museums Pt. 2,” *Blooloop*, April 1, 2017, <https://blooloop.com/museum/in-depth/gamification-museums-aardman-amnh/>.

<sup>61</sup>Lalla Merlin, “Gamification and Museums Pt. 2,” <https://blooloop.com/museum/in-depth/gamification-museums-aardman-amnh/>.

The creators suggested leaning into “natural museum behavior.” They knew that visitors were already walking through these halls, so with MicroRangers, guests were motivated to stop and “look for” the specified objects in the exhibit. This action builds upon pre-existing museum behavior. The creators assert that AR does not make sense if one neglects to “look at the world.” This claim can counteract the idea that visitors would be too focused on their phones to adequately take in the exhibits around the exhibit.

Fortugna and Joseph explain that even simple tools can be used to create impressive or powerful game mechanics and experiences in a relatively short amount of time. It is important for those who wish to create games for museums to fully understand the educational intent. Joseph presented a “toolkit for digital design” highlighting the crucial points of museum game design: user research, rapid prototyping, public piloting, iterative design, youth collaboration, and teaming up.<sup>62</sup>

MicroRangers was successful in supporting visitor education and engagement. It could serve as a model or inspiration for other sites that may be considering implementing some type of game experience. Barry Joseph’s views on games creating zones of proximal development also suggest that video games can be tools for constructivist learning.

These findings are reflected in Barry Joseph’s book *Making Dinosaurs Dance: A Toolkit for Digital Design in Museums*. He provides insight into the implementation of the game *Minecraft* in the American Museum of Natural History (AMNH). Are *Minecraft* players

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<sup>62</sup> Nick Fortugna and Barry Joseph, “Games and Education Virtual Talk” (NYCMER Roundtable, March 8, 2023, virtual).

interested in science-based maps? <sup>63</sup> Can games and play be used to foster motivation for learning?<sup>64</sup>

Joseph offers some of the ideas informing his work. He spoke with linguist James Paul Gee about games and museums. Gee says that if one has not experienced something for themselves, they lack the context to comprehend its meaning. This highlights the need for prior experience when entering a museum, which he views as being a very text-driven space. This is as opposed to games, in which people understand a game's manual, lore, etc through their prior experience of playing the game. Joseph concludes that games prepare visitors for meaning making while at the museum, and have experiences that can change thoughts and behaviors.<sup>65</sup>

He also spoke to Jeffrey Yohalem, lead writer for several video games developed and published by Ubisoft Entertainment. Yohalem says that “well-designed” games teach players different skills during every task, and then put them all together “as a kind of test of what you have learned.” This demonstrates that learning how to play a game is learning in itself, a concept that could be expressed in other areas of life.<sup>66</sup>

Three separate *Minecraft* experiences were implemented by Joseph and his team at AMNH, with three different degrees of user participation and agency. To create a seamless integration of these experiences in the museum, clear learning goals were established. During a program called “Minecraft at the Museum,” youths were “challenged” to create their own

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<sup>63</sup>Barry Joseph, “Designed Game-based Learning” in *Making Dinosaurs Dance: A Toolkit for Digital Design in Museums* (Washington, DC: AAM Press, 2023), 41.

<sup>64</sup>Barry Joseph, *Making Dinosaurs Dance*, 43.

<sup>65</sup>Barry Joseph, *Making Dinosaurs Dance*, 43-44.

<sup>66</sup>Barry Joseph, *Making Dinosaurs Dance*, 45.



educational experiences in *Minecraft*. By the end, they had built a foundation to expand upon for wider public use.<sup>67</sup>

*Minecraft* was also integrated into an existing museum youth mentorship program. Students were challenged to create learning activities on a custom-built map made to look like a human body. After they crafted their activities, they made “Let’s Play” videos that provide viewers with a general walkthrough, personal commentary, and additional educational content. Additionally, the map and its activities were uploaded onto the AMNH games website.<sup>68</sup>

Joseph concludes with a few key discoveries. *Minecraft* helped students connect with and demonstrate their knowledge of the content. Their hands-on experience allowed for greater relations between the information and its applications in the (virtual) world. This demonstrates the active learning that is constructivism. The Let’s Play videos were used as a kind of success metric that showed student understanding of the topic. The collaboration and educator feedback highlights the importance of social interaction in learning. Overall, *Minecraft*, and games in general, have the opportunity to be a vehicle to engage and educate people.<sup>69</sup> Using a popular commercial game fosters intrinsic motivation, in which players will complete learning activities because it is enjoyable.

While visiting The Franklin Institute (TFI), a science museum in Philadelphia, instances of constructivist learning theories being put into practice were observed. The site boasts many different interactive exhibit features and activities. For example, the “Tech Studio” space is designed for hands-on experimentation and collaboration. One activity involves building aircraft

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<sup>67</sup>Barry Joseph, “Designed Game-based Learning” in *Making Dinosaurs Dance: A Toolkit for Digital Design in Museums* (Washington, DC: AAM Press, 2023), 65-67.

<sup>68</sup>Barry Joseph, *Making Dinosaurs Dance*, 67-68.

<sup>69</sup>Barry Joseph, *Making Dinosaurs Dance*, 69-70.

out of K'Nex, a rod and connector building system with interlocking pieces. Visitors, children and adults alike, constructed unique crafts and tested their flying and landing capabilities.

Visitors were often observed trying multiple times, creating new designs and iterations. Many visitors collaborated with their other group members, some even showing friendly competition.

In 2018, TFI hosted Game Masters: The Exhibition, an internationally touring exhibit showcasing video games and video game culture. It was a creator centered exhibit that featured recorded interviews with developers, concept art, early drafts and over 100 games for visitors to play. They also hosted several after-hours events for adults.<sup>70</sup> An 8-bit-style game, *The Adventures of Benjamin Franklin*, was created to coincide with the exhibit.<sup>71</sup> The game was built using Scratch, a free online block based coding system. This allowed for guests to participate in the design process.<sup>72</sup>

An immersive experience in the sandbox game *Roblox* was launched by The Franklin Institute in 2022. This experience, called CurioCity, features mini-games and escape rooms based on the exhibits in the museum. CurioCity is free and available to all those interested. It can be accessed via The Franklin Institute website.<sup>73</sup> The organization worked with a metaverse development company, MELON, to build the project. Using this connection, TFI was able to offer visitors a new gaming experience that can be accessed remotely. Chief experience and strategy officer Abby Bysshe sums it up well:

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<sup>70</sup>Julia Hatmaker, “ Play More Than 100 Video Games at the New Exhibit at the Franklin Institute,” *Penn Live*, March 29, 2018,

[https://www.pennlive.com/entertainment/2018/03/play\\_more\\_than\\_100\\_video\\_games.html](https://www.pennlive.com/entertainment/2018/03/play_more_than_100_video_games.html).

<sup>71</sup>“The Adventures of Benjamin Franklin,” The Franklin Institute, accessed July 10, 2023, <https://www.fi.edu/en/adventures-benjamin-franklin>.

<sup>72</sup>Michael Maley, feedback to author, July 17, 2023.

<sup>73</sup>“CurioCity,” The Franklin Institute, accessed July 21, 2023, <https://www.fi.edu/en/curiocity-new-roblox-game-franklin-institute>.

Metaverse platforms like Roblox are a logical next step for The Franklin Institute, providing a highly relevant medium to connect with future audiences at a young age and pique their curiosity about science and technology...Through CurioCity on Roblox, we are reaching a community of young thinkers where they are already socializing, creating, and sharing experiences together with friends, and are introducing valuable insights and resources to these new audiences in a highly engaging and entertaining way.<sup>74</sup>

The Franklin Institute can help demonstrate the constructivist learning principles in museum settings. In the Tech Studio, visitors learn through hands-on, social activities. By hosting the Game Masters exhibit and implementing *Roblox* in their online resources, the educational and cultural benefits of video games are acknowledged.

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<sup>74</sup>Sarah Huffman, “Come Play at The Franklin Institute - in a Roblox Metaverse,” *Technical.ly*, September 29, 2022, <https://technical.ly/civic-news/franklin-institute-roblox-metaverse/>.

The purpose of this project is to create a replicable framework for implementing video games in museums. One goal is to provide museums with suggestions in order to have a starting point for using games in museum education. Furthermore, this study aims to demonstrate the overlap between video game audiences and museum audiences, showing the large market for gaming experiences in museums. Lastly, this project provides a way that museums can stay connected and relevant with younger audiences in an increasingly digital world.

A literature review was conducted first. These sources were collected online via University of the Arts library databases. This literature was organized into five different groups based on their content: Games & Cognition, Video Game Demographics, Museum Visitor Trends, Principles of Constructivism, and Current State. The main sources of data come from published research studies and analyses, along with survey results and statistical data. For the purpose of this thesis, search terms such as “museums, video games, engagement, cognition, education, technology, culture, game narrative, heritage, history, constructivism, scaffolding” were used to narrow down sources. What has been shown indicates a growing contemporary body of research on video games and their effects on cognition, education, and engagement. The sources being referenced are contemporary, and have been published in the past 25 years.

Constructivist principles were demonstrated by recreating Independence Hall in *Minecraft*. The process was documented via video, journaling, and screenshots. This documentation serves as an example that could be used to gather insight and inspiration for creating their own experiences in *Minecraft*. These concepts can also be translated to other existing games or games created by a museum.

*Minecraft* is a 3D open-source sandbox video game that features building and crafting mechanics. Developed and published by Mojang Studios in 2011, *Minecraft* is the best selling game in history having sold more than 238 million copies.<sup>75</sup> The game continues to have a large active player base, with about 164 million players logging on in the past thirty days.<sup>76</sup>

At its core, *Minecraft* is a survival game in which players are spawned into a virtually endless world. Players have the option to play a “survival” mode or a “creative” mode. In survival mode, players collect resources, fight creatures, go mining, and build shelters. The creative mode eliminates enemy mobs, crafting requirements, and survival mechanics, allowing for a true sandbox experience. Construction features an abundance of different material “blocks” such as oak wood planks, smooth quartz blocks, and brick blocks. These can be placed and “stacked” in a multitude of ways to create unique architectural designs and features. The visuals are simple, reminiscent of 16-bit graphics. Worlds are procedurally generated, creating diverse and new environments every time a new game is started. Players also have the option of generating a flat world, absent trees, geographical features, and bodies of water.

*Minecraft* has two editions, *Java Edition* and *Bedrock Edition*. The major difference is what platforms they can be played on. As mentioned previously, *Minecraft Education* is another version that adds additional resources for educational purposes.

For the purposes of this project, the build was constructed in creative mode on a flat world. This was done via an Xbox Series X console running *Minecraft: Bedrock Edition* version

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<sup>75</sup> “*Minecraft* Franchise Fact Sheet,” Microsoft, April 2021, [https://news.xbox.com/en-us/wp-content/uploads/sites/2/2021/04/Minecraft-Franchise-Fact-Sheet\\_April-2021.pdf](https://news.xbox.com/en-us/wp-content/uploads/sites/2/2021/04/Minecraft-Franchise-Fact-Sheet_April-2021.pdf).

<sup>76</sup> “*Minecraft*,” Live Player Count, ActivePlayer, last modified May, 2023, <https://activeplayer.io/minecraft/>.

1.20.0. It should also be noted that the author has prior experience playing *Minecraft*. Design choices were subjective, so appeal and visual accuracy are open for interpretation.

*Minecraft Education* was considered, however certain credentials are required, and the demo lesson would not suit the needs and goals of the project. This edition of the game is unavailable on the console being used. Furthermore, it is important to note that many end users may not have access to this edition as well, posing a possible limitation.

The first step in the process of creating something that would be culturally relevant and had the potential to be educational was to brainstorm possible build ideas. After the initial brainstorming session, a few possible ideas emerged. Ultimately, Independence Hall in Philadelphia, Pennsylvania was chosen. This was due to the historical relevance, access to reference photos, and the wider hypothetical applicability.

Reference photos of Independence Hall and its grounds were obtained from photos taken by the author and Google Images.

The initial building session took place over the course of a three hour period. Most of this time was spent constructing the foundations of Independence Hall. The main central structure was built first. It was built using brick blocks. It measures 58 blocks long by 15 blocks wide. The flooring was installed using spruce plank blocks. The main hall was also roofed using polished andesite stair blocks to match the grey shingles of Independence Hall. The left side secondary structure was built next, along with the framing of the left side archway. These were also made using brick blocks, along with smooth quartz blocks and slabs (half the height of a normal block) for the white detailing. The pathway beneath the archway used brick blocks, along with smooth

stone slabs. A rudimentary pathway was added to extend from the steps leading to the door. This served as an initial reference for where the plaza would be, and to where it would extend to.

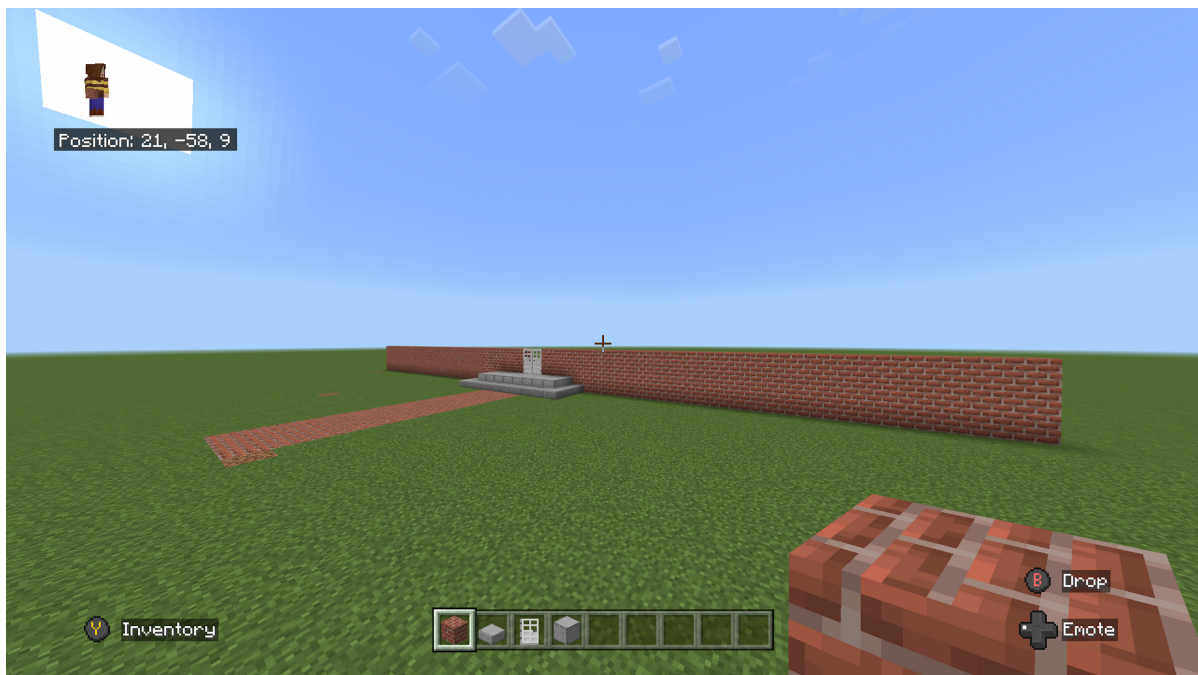


Figure 1: Main hall foundation.

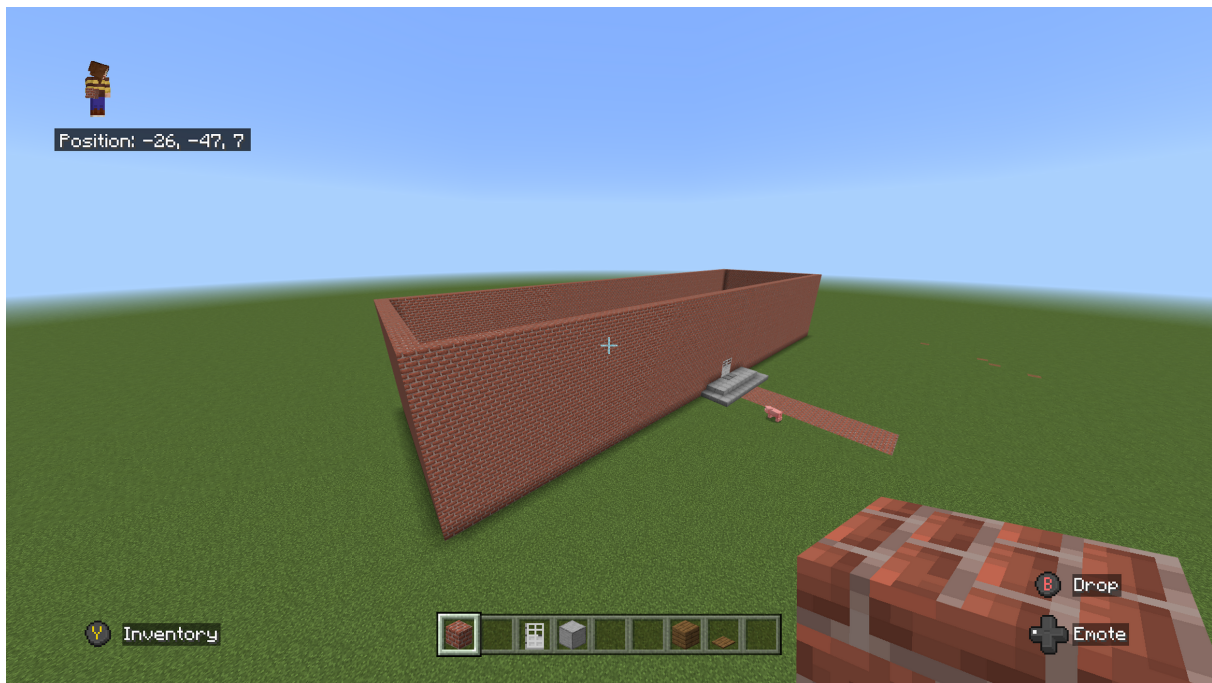


Figure 2: Main hall walls complete.

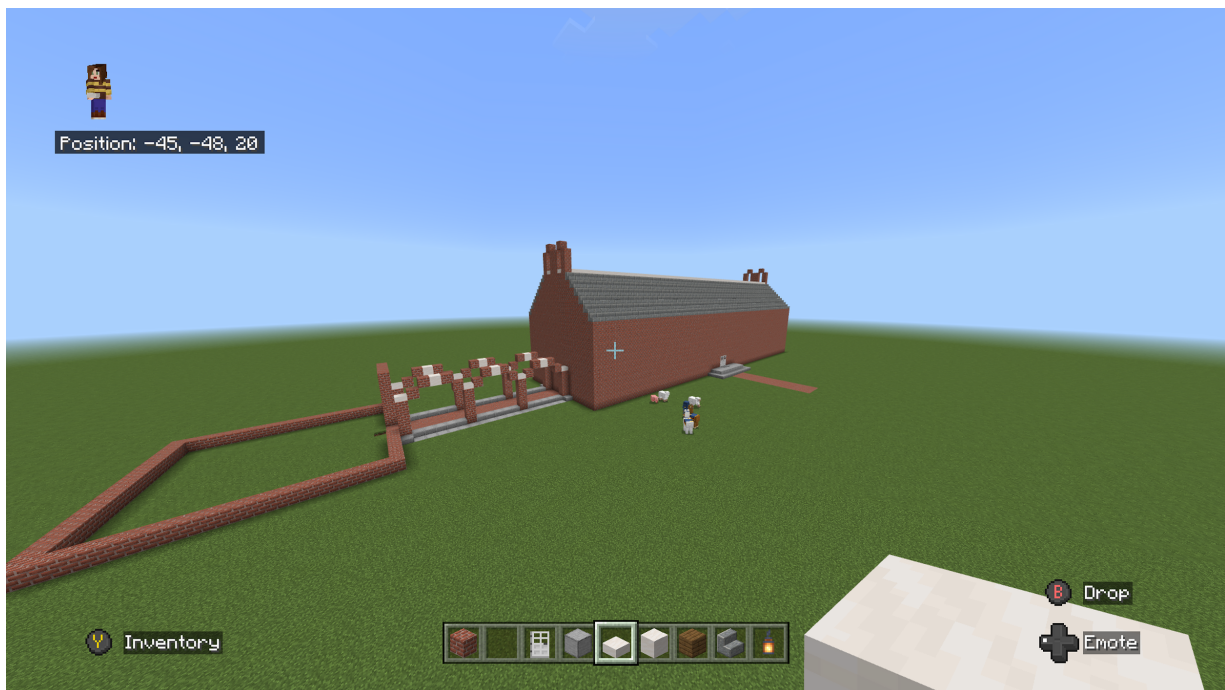


Figure 3: Main hall roofed. Secondary structure and archway framing.



The second session also took place over a three hour period. During his session another player, “Player 2,” joined in the construction. Player 2 has experience playing *Minecraft*. Before additional work began, the main structure was downsized to 48 blocks long by 15 blocks wide. The right side secondary structure and the archway framing were built. Both secondary buildings and archways were then roofed using polished andesite slabs. Smooth quartz stairs were added on the roof. Construction of the clock tower began, using brick blocks and polish quartz blocks. The clock face was cut out and light blue stained glass panes were installed. Player 2 added detailing on the main hall, using smooth quartz blocks for the wall accents. They cut out 17 windows, then put in glass panes. All of the windows, besides the two directly next the door, use two glass panes and four stained white glass panes. This is to replicate the white window coverings that obscure the majority of the windows on Independence Hall. The two windows next to the door use six glass panes. The secondary buildings each have nine windows complete with glass panes. Player 2 also began work on the plaza. They first set a few reference points to guide how large to make the plaza. To install the plaza, the existing grass blocks making up the ground had to be removed. Once removed, they were then replaced with either brick blocks or sandstone blocks, depending on location.

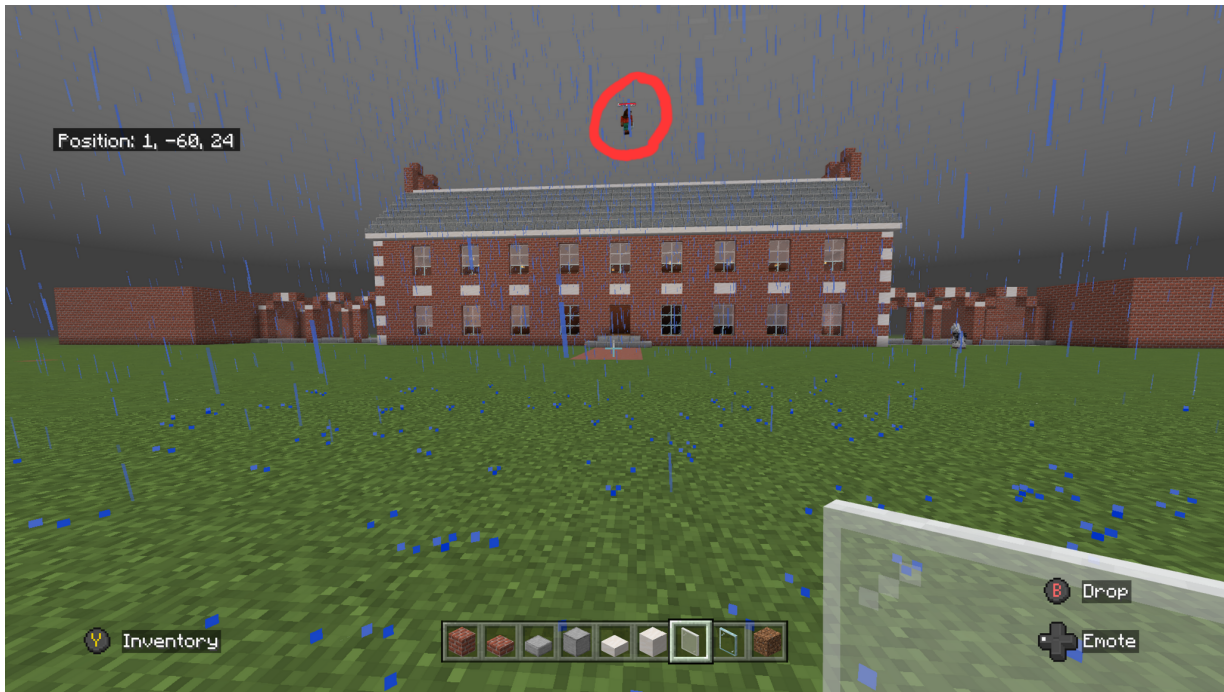


Figure 4: Guest builder (circled) completes windows.



Figure 5: Secondary building and archway roofs complete.



Figure 6: Clock tower and plaza in progress.

No additional builders were present for the final three hour session. The clock tower was completed, and accents were added for greater accuracy and visual appeal. Diorite wall posts, brick wall posts, birch fencing, end rods, and polished andesite slabs were used to attempt to best replicate the intricacies of Independence Hall. Additionally, birch fencing and diorite walls were added to the roof of the main hall. The plaza was finished, and fencing and blocks representing two statues were added.

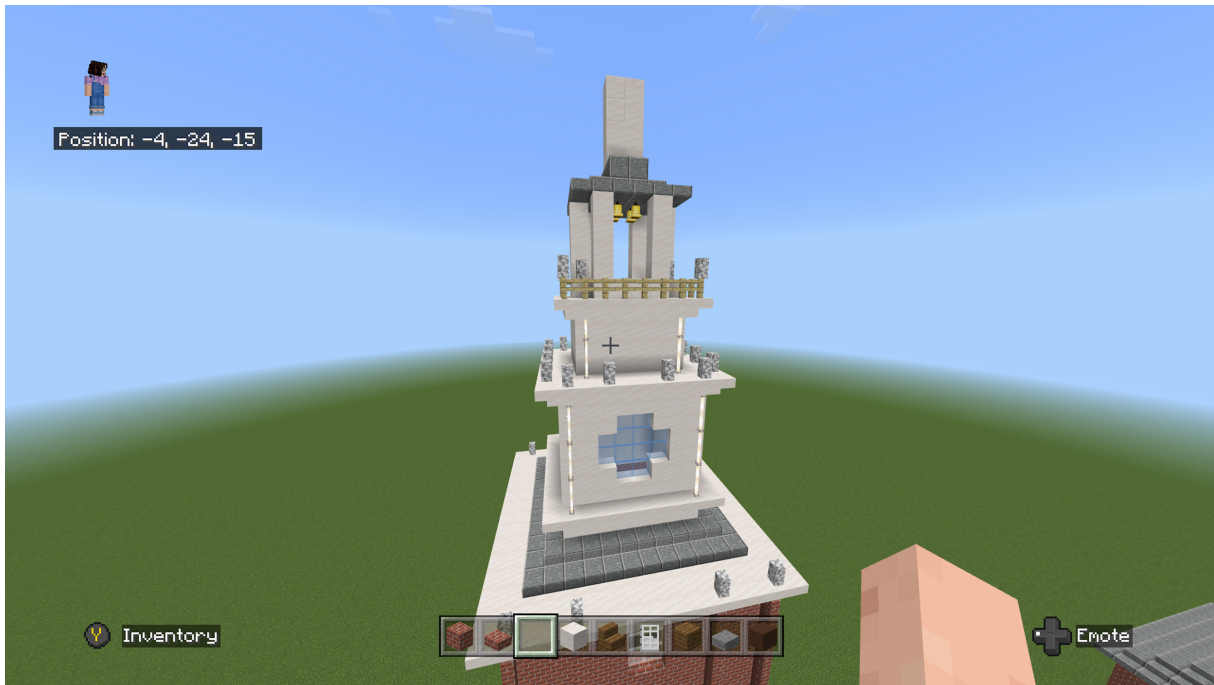


Figure 7: Clock tower complete.



Figure 8: Additional clock tower and roof detailing.





Figure 9: "Statues" added.



Figure 10: Build complete.

*Minecraft* proved to be a useful method of creating something that could serve as an educational tool for a museum or site. The main reasons that *Minecraft* was chosen were that it is highly user-friendly and offers a great degree of creativity. Its sandbox nature allows for lofty ideas and making mistakes. This latter point was emphasized during the process of this project. Essentially anything can be created in *Minecraft*, but a major limitation is time. If on a tight schedule, there may be less room for large mistakes, something to consider if creating something that is to be used educationally in a museum setting, or on a museum website.

These findings demonstrate what it was like to attempt such a project in a limited setting. However, it provided valuable insight that can be translated to museums and schools. This particular build concept has potential to be the foundation for something at several different sites, such as the Museum of the American Revolution and the National Constitution Center, both in Philadelphia. Through building Independence Hall, players can gather experience and prior knowledge that can be connected to the content at the sites, as both sites explore topics relating to the Founding Fathers, the American Revolution, and Independence Hall. Other build concepts can be implemented in a diverse range of museum types besides history museums. A project like this could look a few different ways when transferred to a museum setting. For example, it could be built by an internal team and then uploaded online for public access. Alternatively, a program can be created around building something in *Minecraft*, as demonstrated by the American Museum of Natural History. *Minecraft* could also be a tool for school outreach by connecting educators and students in a unique virtual world. *Minecraft* could be a useful

method of reaching science, geography, and history education standards in a way that is fun and familiar to learners.

There were many design changes during the course of the construction. For example, the main building initially measured 58 blocks long. It was shortened to 48 blocks to better represent the size and proportions of the real Independence Hall. Creative mode features quicker construction and demolition, allowing for greater freedom to make changes to the design. The sizing down increased visual appeal and accuracy. It also fixed an issue involving spacing between the windows on the main hall. On the initial 58-block long hall, the windows were spaced too far apart. More windows could have been added in to fill the space, however this would have been at the cost of accuracy.

Due to the current limitations in *Minecraft* some aspects of the design required using unconventional materials. While viewing the face of the building, the question was raised as to what should be used to replicate the four white thin panels that run vertically on the facade of Independence Hall. The guest builder suggested using an in-game object called an “end rod.” Typically, these rods function as light sources in the survival mode. It was compared with another block, diorite wall, stacked vertically to create a “pole.” It was agreed that the end rod provided a better visual match when compared to the reference photos. Another instance regards the white painted wood that makes up half of the clock tower. *Minecraft* lacks any painted wood blocks, thus smooth quartz blocks were used instead, providing a successful visual match.

This process also highlighted the benefit of having more than one builder. As mentioned previously, an additional builder was brought in on the second session. The addition of more builders brings in new diverse ideas, and demonstrates the benefits of collaboration. During this

session, progress doubled from the previous session. With more individuals participating, a greater number of assets can be built in the same amount of time, potentially less.

The construction process uncovered a pinch point regarding scale. Without the actual dimensions of Independence Hall, it is nearly impossible to have an accurate model to scale. This issue was most prevalent while working on the clocktower. Due to inaccurate dimensions and sizing, building a rounded clock and steeple were not possible without demolishing the structure and starting over. Ultimately, it was kept as is in order to remain on schedule.

Due to the time limitations, the interior of Independence Hall was not built. While they have flooring, the buildings' interiors do not match their real-life counterparts. Creating the interior of Independence Hall may prove to be more difficult than the exterior. This is due in part to the limitations of *Minecraft*. The game does not feature many pieces of furniture, and some artistic liberties may be necessary to complete the interior. The backside of Independence Hall was also not able to be completed, and lacks detail.

It is important to have a clear idea of what will be created before beginning. Beginning without a stable starting point can cause issues throughout the process, like having to demolish things or make drastic design alterations. It also clarifies the goals and progress points of the build. Having a clear idea of what will be built allows for more freedom for other builders that may be participating as well. They can have the opportunity to work on things how they please, as long as it hits the established objectives of the overall build. When Player 2 joined, they were simply told to have reference photos on hand and to work on anything they wanted, as long as the main builder was not currently working on it. They were able to communicate in real time through voice call via Discord, an instant messaging social platform. This allowed for clear and



consistent communication, and Player 2 was able to ask to have their progress checked whenever they wished. Since they were prepared with reference photos, they could build at their own pace while still staying in contact with the main builder, and achieving the objectives of the build session. This creative freedom is necessary, as the construction process is a work of collaboration that should be enjoyable to those involved.

This reflects some of the findings from the existing literature relating to using *Minecraft* in an educational setting that demonstrates constructivist concepts. Constructivism suggests that people actively build their knowledge and understanding through experiences and interactions. The constructivist learning theory asserts that social interaction is crucial to learning and developing knowledge. Learners use their existing knowledge to reflect on new information and fit it in their pre-existing knowledge structures.

Active learning is one of the key principles that emphasizes hands-on activities in which learners explore and manipulate their world. Learners interact and experiment with their environments to gather meaning. Knowledge and meaning is built through experiential learning. Creating something of cultural relevance in *Minecraft* is shown to be a successful active learning method. Player 2 is not local to Philadelphia, yet reported that “it's pretty fun to build something historic like that... it's cool because it made me look more stuff up about it (Independence Hall).”<sup>77</sup> This suggests the acquisition of new knowledge, or at least the desire for it, through a gaming experience. Using a game that is familiar and accessible helps to engage and motivate. A sandbox game such as *Minecraft* allows for freedom and creativity that provide opportunities for building knowledge and interacting with a virtual world.

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<sup>77</sup>Jordon Savacool, text message with author, July 1, 2023.

Another core principle of constructivism involves the knowledge that learners bring with them. Learners bring existing knowledge, beliefs, and experiences to learning processes. The new information they take in is integrated and is used to expand upon existing knowledge structures. As reported by the study by Callaghan, over half of the students had previously played *Minecraft*. Going further, millions of Americans have at least some experience with a video game. In this project, both the author and Player 2 had played *Minecraft* before. Tasks were divided up based upon the skill of the builder. For example, Player 2 felt they were better suited for digging up the grass blocks for the Independence Hall plaza. It was agreed that they would work on that part of the construction. Sharing individual knowledge and experiences helps inform how tasks will be completed and by whom. It also opens up opportunities for those of an advanced skill set, often referred to as a “more knowledgeable other,” to assist others.

This directly relates to the concept of the Zone of Proximal Development. This refers to the gap between a learner’s current level of understanding, and their potential level with the help of a more-knowledgeable other. Social learning settings support learners by providing guidance and scaffolding. The literature and project were consistently demonstrated aspects of this concept. While both the author and Player 2 had played *Minecraft* previously, many tips and ideas were shared. Callaghan’s study saw experienced players helping new players. These instances help highlight the benefit of guidance and collaboration in learning.

It was shown that constructivism recognizes that social interaction is important and beneficial to learning. Through collaboration and discussion, learners can engage with others and exchange ideas. This can also help learners change their personal opinions. As shown in the study done by Licensberg and Eynon, *Minecraft* proved to be a great motivator for social

interaction. When given a task, players seem to naturally collaborate. Even if this collaboration and interaction is not in person, as was the case for this project, the exchange of ideas is still possible, and is a vital part of the learning process.

Constructivist learning theory prioritizes authentic, meaningful tasks that connect learning to real-world applications. Meaningful tasks encourage engagement and promote motivation because the relevance and the purpose for learning are demonstrated. This has been shown throughout the literature pertaining to *Minecraft* in education and the author's applied project. The process of building Independence Hall proved to be meaningful because it connects to relevant history and because it could be expanded upon and applied in real-life at a site. There was a purpose behind the build, and the goals were clearly defined. Both games and museums work to create meaning, as it helps individuals connect to the stories being told. This in turn can foster empathy and inspire changes in beliefs and behaviors. Furthermore, a meaningful experience allows participants to see value in the real-world applications.

The table below outlines the principles of constructivism in focus, along with how these manifest in a *Minecraft* environment.

Principle of Constructivism	<i>Minecraft</i> Gameplay
Active learning	Hands-on activity, building/creating, experiential
Social interaction	Online/couch co-op, collaboration, exchange of ideas
Pre-existing knowledge	Prior playing experience, watching game content, cultural knowledge
Zone of Proximal Development	Higher skilled players, ability-based task division
Meaningful tasks	Relevance to content, real-world applications, personal connections, intrinsic motivation,

Table 1.

Overall, it has been demonstrated that video games help people learn and improve their cognition. Games help learners develop cognitive skills that enhance their processing abilities. These benefits open up opportunities for using a wide variety of games for educational purposes. Playing video games also has the potential to influence thought and behavior. This is especially to be considered if thinking about implementing a game into a museum setting.

Millions of Americans play some type of video game. This shows that it is a familiar medium for a lot of people. Games are accessible, and are available on a wide variety of platforms like gaming consoles, computers, cell phones, and tablets. In addition, many Americans consume video game content such as Youtube videos and live streams.

The sheer amount of video game players suggests that a large number of museum visitors are gamers. This is especially the case with younger visitor groups like Gen Z and Millennials. These two demographic groups are also shown to be less connected with museums. Many children visit museums on field trips, however, repeat visitation and general frequency is negligible. Millennials do visit museums as well, but not at the rate that is to be expected from the size of the generation. Furthermore, Gen Z and Millennials are not becoming more interested in museums as they age. While there is not enough published research to offer specific and clear reasons why, the author speculates that Gen Z and Millennials are not frequently visiting and engaging in museums because they do not appeal to their interests and are dull in comparison to the abundance of other experiences and activities available to them.

All of these points present an interesting and exciting opportunity for video games to be used for educational purposes in learning settings, like a museum. Video games could serve as the vehicle to engage and educate visitors in a way that is relevant, exciting, and social.

Drawing upon the lens of constructivist learning theory, similarities can be found between the immersive experience of video games and the engaging moments found within museums. Because video games embody elements of constructivist principles and museums serve as ideal settings for such learning theories, the integration of video games within the museum is a promising method for creating enriching educational practices.

Three museum visitor types have been identified as being the focus for these practices: school groups, young families, and experience seekers. School groups consist of students and their teachers or chaperones. In this case, school groups between the grades 3-12 are being considered. Depending on the offerings of the site, these visits may be guided by a museum educator. School groups often focus on content that is a focus in class or curriculum. The experiences in this group are shared and interaction is encouraged. Young families are also “experience sharers.” For the purposes of this project, young families are being defined as families with children and adolescents. Having fun, meaningful experiences with their loved ones is a significant motivator for this profile. While parents value the educational aspect of the visit, the content they explore with their children is not necessarily confined by curriculum or standards. Experience seekers are attracted to unique and exciting experiences in the museum setting. This group can be very broad, but individuals within the Gen Z and Millennial generations are being focused on. These young visitors are drawn to the museum through its “must see” experiences. They are also more likely to share their experience with others and return to the museum.

These profiles all represent young, experience sharers that value interaction and activity. These types of visitors are explorers who look for immersive experiences that enrich their everyday lives. They are in touch with contemporary trends and technology because they have been immersed in them throughout their lives. These visitor profiles present three visitor types that would be appropriate audiences for museum video game experiences.

Within the context of these profiles, for parents and teachers the benefit of games lies in their inherent attraction to youths. The value lies in the educational benefits that a museum gaming experience can support.

Figuring out the value for the players themselves can be more tricky. What's in it for them? Where do their values lie? Striking a balance between a captivating player experience and meeting educational objectives is vital. Not every gamer can be spoken for, but a large part of the value can derive from their passion for gaming in general. Visitors see the value of being able to play a game. For others, the creation process holds value as well. Programs that incorporate the creation of a gaming experience allows players to become storytellers and contribute tangibly to participatory culture. Others may be interested in a game concept because it touches on a personal interest, like history, or relates to a future career aspirations. Yet, understanding the wide range of value and benefits that a museum gaming experience gives players requires additional research that delves into player perceptions and aspirations. This highlights the significance of thorough user research, serving as the guide to discover the various ways players appreciate and find value in gaming.

The following tables provide visuals to clarify these conclusions. Table 2 highlights the similarities between museum and game experiences by examining them through a constructivist lens.

The process of creating Independence Hall in *Minecraft*, along with the literature uncovered, has led to the formulation of some suggestions for museums interested in using games for educational purposes, such as in programs, interactive activities, or online resources. Table 3 highlights areas where games could be implemented and some of the benefits of doing so. Finally, suggestions for museums using video games in education are provided in Table 4. These suggestions have been formulated based upon the discoveries made through the literature researched and the project built.

<b>Constructivist Principle</b>	<b>Museum Setting</b>	<b>Game Setting</b>
Active learning	<ul style="list-style-type: none"> <li>● Interactive exhibits</li> <li>● Hands-on activities</li> <li>● Crafts</li> <li>● Experimentation</li> </ul>	<ul style="list-style-type: none"> <li>● Interactive experience</li> <li>● Player freedom</li> <li>● In-game tutorials, glossaries, indexes, etc</li> <li>● Completing missions and objectives</li> <li>● Character leveling</li> </ul>
Social interaction	<ul style="list-style-type: none"> <li>● Family/group outing</li> <li>● Tour groups</li> <li>● Programs</li> <li>● After-hours activities</li> </ul>	<ul style="list-style-type: none"> <li>● Online connectivity</li> <li>● Couch co-op</li> <li>● Competitive games</li> <li>● Gaming tournaments</li> <li>● Twitch streams</li> </ul>
Pre-existing knowledge	<ul style="list-style-type: none"> <li>● Prior experiences</li> <li>● Previous education</li> <li>● Personal beliefs, opinions, and attitudes</li> </ul>	<ul style="list-style-type: none"> <li>● Prior experience playing</li> <li>● Watching game content</li> <li>● Reading game guides</li> <li>● Online game “wikis” or other websites</li> </ul>
Zone of Proximal Development	<ul style="list-style-type: none"> <li>● Museum educator</li> <li>● Docents and tour guides</li> <li>● Teacher during school trip</li> <li>● Other visitors</li> <li>● Family “expert”</li> </ul>	<ul style="list-style-type: none"> <li>● Higher skilled players</li> <li>● Higher level players</li> <li>● Non-playable characters</li> <li>● Gaming content creators</li> </ul>
Meaningful tasks	<ul style="list-style-type: none"> <li>● Contextualization of objects and concepts</li> <li>● Connecting stories to visitors</li> <li>● Demonstrating content relevance</li> <li>● Fitting visitor needs and expectations</li> </ul>	<ul style="list-style-type: none"> <li>● Completing objectives, missions, and levels</li> <li>● Impact of decisions and actions on world state</li> <li>● Working to advance skill or ability tree</li> </ul>

Table 2.



Museum Application	
On-site programming	<ul style="list-style-type: none"> <li>● In person experience</li> <li>● Immersion</li> <li>● Hands-on activity supports active learning</li> <li>● Connects content to game application</li> <li>● Promotes social interaction and collaboration</li> </ul>
Online engagement	<ul style="list-style-type: none"> <li>● Accessibility</li> <li>● Brings museums to homes</li> <li>● Familiar space</li> <li>● Broader reach</li> </ul>
School outreach	<ul style="list-style-type: none"> <li>● Brings museums to classrooms</li> <li>● Peer collaboration</li> <li>● Educator online connectivity</li> <li>● Familiar space</li> <li>● More-knowledgeable other guidance</li> <li>● Develop relationships with schools</li> </ul>

Table 3.

Suggestions for Practice	
Make meaning	<ul style="list-style-type: none"> <li>● Relate game to content</li> <li>● Connect visitor experiences to stories</li> <li>● Build empathy</li> <li>● Clarify game objectives/goals</li> <li>● Highlight how goals connect to content and learning goals</li> </ul>
Lean into natural behavior	<ul style="list-style-type: none"> <li>● General intrinsic motivation to play games</li> <li>● Existing individual gaming habits</li> <li>● Connect online</li> <li>● Create something others can enjoy</li> </ul>
Use what is already available	<ul style="list-style-type: none"> <li>● Commercial games ex., <i>Minecraft</i>, <i>Roblox</i></li> <li>● Free game development software ex., Construct 3, Unity</li> <li>● Open source programs ex., Defold, GDevelop</li> <li>● Paid game development software ex., RPG Maker, GameSalad</li> </ul>
Use connections	<ul style="list-style-type: none"> <li>● Look beyond museum field</li> <li>● Ask current connections</li> <li>● Research companies that align with goals</li> <li>● Demonstrate how museum/education goals align with game design goals</li> </ul>
Involve visitors	<ul style="list-style-type: none"> <li>● On-site programming</li> <li>● Online connectivity and accessibility</li> <li>● School outreach programs</li> <li>● Visitor involvement in creation</li> <li>● Visitor testing and feedback</li> <li>● Visitor generated content</li> <li>● Encourage collaboration</li> </ul>
Create fun	<ul style="list-style-type: none"> <li>● Stay true to motivation behind gaming</li> <li>● Listen to visitor feedback</li> <li>● Monitor visitor engagement</li> <li>● Make modifications if necessary to meet player expectations</li> <li>● Enjoy the process</li> </ul>

Table 4.

Museums provide a great space for implementing constructivist learning activities and theories. With their interactive settings, they offer a range of diverse experiences that can cause shifts in personal meanings and beliefs. Video games, particularly sandbox games such as Minecraft, can serve as vehicles for similar immersive experiences. It is imperative for museums to recognize the significant presence of video gaming among their young visitors. To remain relevant and engaging, museums must build a connection that resonates with these audiences, harnessing their familiarity and passions. By doing this, museums convey not only a genuine interest in their visitors, but also a willingness to grow with them. Gaming culture is culture. Therefore, for museums to effectively share and participate with culture, embracing gaming culture is essential. Failure to adapt could render museums obsolete during the virtualization of society, ultimately causing a disconnect with younger audiences. By seamlessly integrating video games into educational frameworks, museums can bridge the gap and establish meaningful connections with these vital audiences.

## Implications for Future Research

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The work completed for this project has strengthened the author's passions for video games and museums and has led to the formulation of ideas about how this research can be continued. One such idea involves looking at more games that can be used for educational purposes. For example, the game *Assassin's Creed Odyssey* features a game mode called "Discovery Mode." This game mode acts as a virtual museum, which features guided tours by historical figures like Leonidas. Players can immerse themselves in a historically accurate Ancient Greek experience. Museums that house Ancient Greek galleries, like the Metropolitan Museum of Art, could look at this game as an opportunity to engage visitors virtually with their collection. Other games, such as *Crusader Kings*, could be utilized to teach geography and stimulate alternate history scenarios.

More experimentation with games that museums are already offering is necessary as well. Time limitations did not allow for ample time to be used testing and playing games. Exploring more museums and their game offerings can help refine the suggestions presented. It can also inspire more ideas on unique ways of integrating games into museum spaces.

Speaking with video game players in order to gauge their interest in museums implementing games would also be a beneficial avenue to explore. Interviewing gamers could offer valuable insight into visitor expectations and needs. They could also serve as a source for generating new ideas on how to implement games in museums.

The integration of video games and museums can transform museum education. As society deepens its relationship with technology, museums can look towards video games as a way to connect to visitors, stay relevant in the world, and educate audiences in new and exciting ways.

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