

Mining for Social Skills: Minecraft in Home and Therapy for Neurodiverse Youth

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Abstract

The Minecraft game platform has widespread popularity among children, including neurodiverse children with Autism Spectrum Disorder and Attention-Deficit Disorder. A critical area of therapeutic focus for neurodiverse children is social learning to enhance their social connections. We conducted exploratory research to better understand the role of Minecraft in the lives of neurodiverse youth, from the perspective of parents and clinics servicing this population. Via interviews and a focus group, we inquired into the perceptions and goals of clinics that have incorporated Minecraft into their services and parents of participating youth. Our findings are rich descriptions of the current social lives and gaming practices of neurodiverse children. Although parents and clinicians observe positive social interactions through Minecraft, parents grapple with their goals of supporting their children's social lives and their reservations regarding online gaming communities. Parents and therapists desire more connections between virtual and face-to-face social relationships. Our findings point to the opportunity for clinicians, parents, and technology designers to facilitate social learning in online environments such as Minecraft due to its affordances to facilitate cooperation, modeling, joint attention, and performance in a safe, compelling environment.

1. Introduction

Neurodiverse (ND) is an inclusive adjective for people with conditions stemming from variations in brain function, including but not limited to Autism Spectrum Disorder (ASD), Attention Deficit Disorder, Attention Deficit Hyperactivity Disorder, and learning disabilities [6]. Treatment of autism and related conditions is approached in a variety of ways, including medical, psychological, educational, and therapeutic methods. Therapeutic options include speech, occupational, physical, and social therapies. Social learning is a critical component in the

development of a child with autism¹ because early social deficits can affect interpersonal, coping, and adaptive skills for an entire lifetime [26].

One avenue for socialization for ND children is online gaming communities, which bring together diverse players who, by the nature of the open community, are both ND and *neurotypical* (NT). Minecraft is one game that has found wide popularity among ND and NT children [3,22]. Its creative style of play and flexible, extensible platform has captured the imaginations of players and developers.

Although the media often casts online gaming in a negative light, Minecraft's game play and social dimensions have made it popular with educators, child therapists, and even librarians. These professionals are actively evaluating and incorporating Minecraft into their educational, therapeutic, and community-building programs [7,23]. Even prior to Microsoft's purchase of the original publisher in 2014, the game's creators invested in outreach to educators. Today, the Minecraft Education Program includes the capacity for an education organization to host a Minecraft server specifically for their students [28]. A growing number of constructionist educators and education researchers have embraced Minecraft because it affords a creative space for students, one that allows easy sharing of creative work in a collaborative environment [16]. Some clinics and other support organizations for ND youth have also chosen to integrate Minecraft into their services.

The broad popularity of Minecraft in multiple contexts requires technology providers, notably parents and therapy providers, to assess the game's role in children's lives, including the potential positive and negative impacts of online gaming. Our exploratory study examines the impacts and opportunities of parents

¹ We use terms such as "individuals with autism" and "autistic" interchangeably to reflect the diversity of preferences within the ND community [15].

and professionals who support Minecraft gameplay for their children. Our research questions were:

RQ1: What are the perceptions and goals of the clinicians and staff deploying Minecraft programs in support of neurodiverse youth?

RQ2: What are the perceptions and goals of the parents of neurodiverse youth who participate in these Minecraft programs?

To investigate, we conducted interviews and a focus group with professionals and client parents from two clinics where Minecraft has been adopted. We selected technology providers for this exploratory study to lay a foundation for conducting empirical research directly with the ND children. Our inductive analysis yielded rich descriptions of the social lives of ND children and the gaming practices of the children and families. We gained an understanding of the motivations and challenges of the professionals who make technology choices in order to provide compelling experiences for their clients, towards the goals of emotional regulation and social learning. Themes emerged regarding (1) the qualities of the Minecraft community and environment that lead to engaged social learning; (2) the tensions parents feel between the desire to give their children opportunities to socialize and their concerns about games and online gaming; and (3) the perceived opportunities and challenges regarding connections between virtual and real-life social behaviors.

Our research contributions are insights into the lived experiences of families with ND children in the areas of social engagements and gaming practices, as well as the experiences and goals of professionals serving them. We contribute preliminary evidence that the Minecraft environment promotes social learning due to its affordances to facilitate modeling, attention, imitation, and performance. System designers and administrators can bolster these affordances to further support the socio-technical value of online games.

2. Overview of Minecraft

The alpha version of Minecraft was publicly launched on an independent game development forum in 2009 [10]. By September, 2014, when Microsoft purchased its parent company for US\$2.5B, Minecraft had sold more than 50M copies [18]. Versions of the game can run on multiple platforms: personal computers, major game consoles, and many handheld devices. Basic play, often compared to virtual LEGO play, involves using resources from the game's blocky 3D environment (see Figure 1) to create objects or structures for one's avatar (the in-game character controlled by the player). Depending on the platform and personal preference, play can be either solo or multiplayer. In multiplayer, the gamer is either playing

local multiplayer (i.e. two people playing on the same game console) or playing online. The base software is extensible, allowing re-skinning (alterations to object appearances) and modding (incorporating software add-ons ("mods") that alter the game environment).

Another permutation of play is based on Minecraft's play mode. In Survivor Mode, one's avatar needs to defend itself from threats from aggressive mobs (server-controlled characters). Avatars can also be hurt by environmental hazards, such as burning in lava or drowning in water. Avatars can die from hunger if in-game food is not acquired. Player-versus-Player Mode (PvP Mode) has all the threats of Survivor Mode, but other players can also attack one's avatar. Creative Mode removes all threats so players may focus entirely on creative building activities.

3. Related Work

We situate our research in a key component of ND therapy: social learning. We then present current perspectives on the controversial arena of video games for youth in general, with specific considerations for ND players.

3.1. Social Learning Theory and Neurodiversity

Social Learning Theory (SLT) states that learning is a cognitive process that occurs within a social context. Learning is influenced by three elements: environment, behavior, and cognition [2]. The learning process consists of a role model exhibiting behavior, which the learner attends to, internalizes cognitively, and ultimately, performs. The behavior is reinforced by positive or negative consequences to the behavior.

For ND children, social learning is a core component of daily interactions and structured learning via behavioral therapy, social goals, and a variety of learning supports such as social stories and emotional literacy [25,27]. Behavioral therapy is a form of social therapy that focuses on the behavior outcomes of social interactions. Social groups are often used in conjunction with behavioral therapy as a means for



Figure 1: A Minecraft world and avatar.

practicing learned social behaviors in a facilitated environment, incorporating elements of SLT such as imitation, observing, and modeling. A core component of social groups is engaging in cooperative activities, which supports SLT by promoting imitation, joint attention, and a safe environment for practicing new behaviors [8]. Our research explores how social group clinics are extending their community to the online environment of Minecraft, and thus, broadening the opportunity for social learning between face-to-face and virtual interactions.

Within the domain of information systems, researchers have previously looked at social learning theory and interactive media. Most have focused on the development of curriculum for formal learning environments, such as gamification of the classroom [21] and the design of serious games [14]. Less focus has been placed on the potential for social learning in online commercial game software, where learners are already invested and networked.

3.2. Benefits and Drawbacks of Video Games

Soon after the emergence of video games as a social phenomenon, the media, child development experts, and parents began debating the relative benefits and drawbacks of video game play. Recent meta-analysis of research indicates that, while there is still disagreement among researchers, video game play has generally been found to have effects on socialization in child players. The meta-analysis found:

“...playing violent video games increases aggressive behavior, cognition, and affect, and decreases prosocial behavior and affect. No significant effect was observed for the relationship between violent video game play and prosocial cognition (although the effect was in the expected direction). In contrast, playing prosocial video games decreases aggressive behavior, cognition, and affect, and increases prosocial behavior, cognition, and affect” [13].

Despite behavioral concerns, education researchers have found that electronic games can “facilitate learning by fostering learners’ cognitive, behavioral, affective, and sociocultural engagement with the subject matter” [20].

Many parents and experts express safety and privacy concerns for children who play online games [4]. Interacting with others can change the nature of a gaming experience in unexpected ways, particularly if the other players are strangers. Online play can change a game so fundamentally that major ratings groups require special warnings regarding online play since such experiences cannot be effectively rated in advance [29,30]. Also, there exists a certain set of competitive

social norms in gameplay and gamer culture which includes behaviors such as teasing and egging others on. Researchers have encouraged child therapists to have open, non-judgmental dialogues with their clients and parents about the role and impact of video games in their lives [1].

3.5. Minecraft and Neurodiverse Players

Playing video games is a common activity for children with ASD [9], and with Minecraft’s popularity, parents, educators, and therapists need to understand the impacts and opportunities for Minecraft to enhance the education and social connections for ND children. The Minecraft open gaming environment lends itself to a wide-range of gameplay and social interaction, which has the potential to both facilitate and hinder socialization in youth with ASD. The popularity of Minecraft is an opportunity to integrate virtual and real-world social connections. Its “immersive emotional experiences... provide opportunities to practice new regulatory skills... that can lead to generalization outside the game” [11, pp. 75].

ND youth can be stigmatized by broader society [12]. That stigmatization extends into online gaming communities where ND children may encounter situations where they are discussed in subtle and not-subtle ways. Since ND children are a target for bullying [5, 22], parents naturally seek safe places for ND youth to participate online. One such inclusive community is Autcraft, a Minecraft multiplayer environment for children with autism and their families. Ethnographic research on Autcraft has found that the players engage in nuanced social practices, reaching out for, and building, community through gameplay and use of computer-mediated communication channels. The community demonstrates that “there are many ways to be social and Autcraft’s communication ecology gives members technological options to express that diversity” [22, pp. 10].

Therapists have a history of using games and toys as the focus of interventions and therapy for ND children [17,19], so the use of electronic games seems a natural extension. Games designed to promote education skills, like math, are commonly used to supplement educational curriculum. Minecraft is already popular in school-age children and is backed by a corporate education program. However, using fun, mainstream games to supplement ASD therapeutic skills is a recent endeavor, with little research. A child who goes to social skills therapy may experience stigma and resistance to attending therapy. Potentially, if the therapy is connected to Minecraft, the child has another frame to convey, and identity with, his therapy, especially since “games are associated with less stigma

than conventional therapy” [11, pp. 75]. Our research explores the potential role of Minecraft to enhance children’s therapy experience, from the perspective of therapists and parents.

4. Method

In order to gain a perspective from the therapists and parents, we conducted user research with both populations. We selected organizations that provide services to a range of ND youth, some of whom have a diagnosis of ASD, Aspergers, ADD, or a related condition, and some of whom self-identify (or whose parents identify them) with a ND condition. We purposively selected two organizations for their proximity and their advertised Minecraft servers. The first organization, ABC Clinic, is a psychiatric and behavioral health services provider for children, teens, and young adults, and offers a range of programming for ND youth. The second organization, XYZ Group, is a service that provides courses and a support community for people with Aspergers as well as parents, teachers, and therapists (although they welcome the full ND community and do not screen exclusively for Aspergers). XYZ Group explicitly states on their web site that they are not psychological or therapy professionals.

We interviewed two members of the professional staff from each facility, including a program director, a marketing director, a therapist (who manages the Minecraft server), and an employee whose primary role is to manage the Minecraft server. The interviews took place either at their work location or using an Internet voice conferencing application.

Our research with parents consisted of a focus group with five participants (4 mothers; 1 father) and an interview with a mother who was unable to attend the focus group. The six children were ages 9-13 years old. To recruit the focus group participants, the clinic’s program director extended our invitation email to all parents of the program. As a convenience for parents, the focus group was held concurrently with an event hosted for ABC Clinic youth at a sporting facility.

Our inductive analysis was iterative and reflective. After each session, we met to debrief, share notes, and consider revisions to the interview protocols. Recorded transcripts were securely shared with a professional transcriptionist who used Clean Read standards to produce transcripts. Using qualitative text analysis techniques from information systems studies [24], we first analyzed the transcripts open coding in parallel. Codes were iteratively compared, sorted, and grouped to identify the major themes emerging from the interviews, producing a codebook. The transcripts were re-evaluated using the standardized codebook. The

results were compared and any disagreements discussed until reaching a consensus.

5. Findings

Our analysis yielded rich descriptions of the current social lives and gaming practices of the children, who the parents described as having a variety of conditions associated with autism, including ASD, nonverbal learning disability, and sensory processing disorder. We gained an understanding of the motivations and challenges of the professionals who attempt to provide compelling experiences for their clients, towards the goals of emotional regulation and social learning. To explore our research questions regarding the perceptions and behaviors of parents of ND youth and the professionals serving them, we offer these descriptions of their experiences.

Our findings start with the social lives of the children and then are layered with the parents’ and clinicians’ views of games in general, including the threats they observe in youth participation in online activities. We then move to their perceptions of Minecraft, specifically, and how it is differentiated from other online and face-to-face experiences.

5.1. Social Lives and Impetus for Social Skills Therapy

Our participant parents reported experiencing the challenges one expects in a family with ND youth. In describing the difficulties associated with neurodiversity, one parent said that their² child had been bullied at school to the point where the child withdrew. Two parents said that their children had a particularly difficult time transitioning from high energy recess play to focused classroom activities. The majority of families were referred to therapy by their child’s school, connected to challenges the children were experiencing in school. Social interactions were the key driver in their search for community-based therapy services for their children.

Familial therapeutic goals include developing social skills, building confidence, and having experiences in a safe, welcoming community. The parents also cited the physical activities offered through ABC Clinic as a benefit to their child as a source of confidence and for sensory regulation (coping with sensory processing disorder).

² In our findings, we intentionally use “their” as a singular gender-neutral pronoun to further anonymize our participants.

"[My child] has been around kids that are more tolerant ...and develop, by working in small groups, on social skills. Plus the physicalness of climbing is really good for kids with sensory. And so he has really thrived and developed a lot of confidence through the program." (Parent 2)

Comments from the professionals focused on two specific areas for improvement with their young clients: social interactions and emotional regulation. They cited the youths' experiences of having a hard time with transitions, feeling overwhelmed, and expressing thoughts of self-harm. The clinicians emphasized their over-arching goal of fostering safe spaces and a sense of community.

5.2. Gaming Practices of Neurodiverse Families

Parents and therapists both describe gaming as a core component of children's lives. The families (parents, child, and siblings) all play tabletop games (e.g., board or card games) as well as electronic games (e.g. PC, handheld, or console games). Tabletop games were also played at both clinics as a means for building community and socializing.

In the course of discussion, parents mentioned, Monopoly, Blokus, Payday, Battleship, Munchkin and Fluxx as games played in their families. XYZ Group's activity room included copies of Codenames, Apples to Apples, Double, Sushi Go, Yahtzee, and Carcassonne, as well as a standard deck of playing cards and a set of dominoes. ABC Clinic hosts regular play of the fantasy roleplaying game Dungeons & Dragons (D&D), which was also attended by one of the older children participating on the clinic's Minecraft server.

While not technically a game, LEGO building toys were mentioned often during interviews, and have also been studied in autism literature [19]. There are obvious comparisons to Minecraft, as both allow for creative building. Parents and professionals find LEGO play to be a positive creative outlet for their children, but commented that LEGO toys were less social than Minecraft, since Minecraft's built-in features allow easy interactive sharing of one's work. LEGOs were also perceived to have less cachet among youth at the target age range, making feats of mastery in Minecraft more prestigious and accessible than feats of mastery with LEGO toys.

"...A fifth-grade boy might be less embarrassed to say he plays Minecraft than to say he plays with LEGOs [...] A kid who likes LEGOs will often like Minecraft. But I think culturally, there's a little bit of a difference [...] Being a gamer is sort of a cool thing to say and be part of." (Professional 1)

ABC Clinic also hosts indoor rock climbing events. Combined with their Minecraft and D&D offerings, an

ABC Clinic professional described these programs as more "creative" approaches to behavioral health care, which focused more heavily on social cognition than other challenges.

Parents also described a variety of electronic games played in their households. The parents engage in their child's online gaming by either playing along with their child (in a multi-player game or by taking turns) or by sitting with their child, observing, and dialoging with their child about the child's gameplay. In addition to Minecraft, participants mentioned Jurassic World, Wipeout, and The LEGO Movie Videogame as played by one or more of their children at home. One parent also mentioned their child's strong interest in Kodu, a platform for creating and playing games for Microsoft Windows and the Xbox (published by Fuse Labs at Microsoft Research). Although ABC Clinic professionals did not mention other electronic games tied to their offerings, the facilities at XYZ Group include an activity room with a large wall projector for playing console games.

5.3. Concerns of Online Engagements

Parents expressed concern about their children's online activities, particularly in terms of the potential negative influence of others. One parent confessed that they did not really understand the Internet, and was not comfortable allowing their child to participate due to that personal lack of understanding.

"It's more me being fearful, because I don't understand how it all works yet. Not just Minecraft, but everything in general. Like the World Wide Web is still-- I'm very fearful of how quickly things can go from good to bad out there in the Internet." (Parent 4)

Aggressive, antisocial behavior between children is obviously not unique to the Internet, and these behaviors are common concerns for parents of both ND and NT children. Parents of younger children were likely to prohibit their children from participating on public servers, where the likelihood of interacting with strangers is much higher. Our participating parents also expressed heightened concern regarding their children, who already have trouble processing social interactions.

When speaking of online play, parents mentioned many concerns for their children, including bullying, grieving (intentionally impeding someone else's game play or enjoyment), trolling (making provocative statements in order to produce a negative emotional response in others), and other interactions that were upsetting to their children. These negative aspects could even be experienced offline, between siblings playing the same local multiplayer game.

"...All of a sudden, [child 1 is] screaming. And I'm like, 'What is wrong?' He's like, 'He's killing all my

sheep!' Or something like that. And they're just falling apart. And I had to leave everything I was doing in the kitchen and go over and kind of calm the tension and force them to talk to each other. Because it had gone beyond playing the game, and they were now like hurting each other's feelings." (Parent 3)

Some parents worried about their child learning and repeating inappropriate social behaviors. The ABC Clinic professionals expressed concern about transferring gaming behavior to other interactions where such behavior is not appropriate, and about children being the targets of bullying and scams.

One ABC Clinic professional had seen youth in the program pressured to excessive play by online peers, especially in games that have content requiring group play.

"...It almost seemed like [the game] was made in a way that encouraged overuse of the gaming.... I was having guys who were on for, like, six hours straight. And mostly because they felt responsible to their [peers], they felt like they had to be on there.... And you might have people who are in different time zones. So I would have kids who were setting their alarms for like 1:00 in the morning. They would wake up and be doing a campaign with their [peers] from 1:00 to 6:00 AM, in the middle of the night. And obviously, that was very disruptive." (ABC Clinic Professional)

As a result of these concerns, parents restricted online play for their children and professionals avoided most online play experiences for client youth. Generally, parents seemed more willing to play board games with their children than to play electronic games with them. Minecraft stands out as the major exception for all our participants.

5.4. Minecraft Play

The children of our focus group parents varied in how their children played Minecraft. The younger children played Creative and Survivor Modes, while PvP Mode was popular with an older child. ABC Clinic runs in Creative Mode only, while XYZ Group has servers in Creative and Survivor mode, and has recently introduced a special in-game arena for restricted PvP play. Parents seemed to prefer Creative Mode as a relaxed, creative play environment for their children.

"It's a little bit more relaxing if there's no player-versus-player. And I think it's kind of a test ground for building new things and trying new things, and not having that pressure." (Parent 5)

Regardless of the gameplay mode, the children enjoyed building structures like homes, showing these to their parents, spawning (generating in-game) animals, and exploring the world.

Some families did not play Minecraft online, but rather in a solo or local multiplayer environment. Two of the families play Minecraft on Xbox and their friends come to their house to play together, using different controllers, sitting side-by-side. This style of play allows them to avoid interaction with strangers entirely.

Two parents attempted to exert control while still facilitating their child's Minecraft play through the setup of a personal Minecraft server. In these environments, control of the play experience is entirely in the hands of the family. The family can choose to limit who can play with their children, set conditions under which play can take place, and use mods to create the specific play environment they prefer.

The Minecraft game environment affords online text communication. On one hand, that limited channel of communication is eliciting the learning of social skills and forming friendships. The ABC Clinic Server Admin, however, noted several challenges with the chat feature. The primary difficulty is that the chat continuously scrolls, making the conversation flow past quickly and children miss information. When trying to facilitate a group activity, such as touring each other's Minecraft homes, some children miss that information and then are not engaged in the collaborative activity.

5.4.1. Minecraft Permeates Other Activities Both parents and professionals talked about ways Minecraft permeates into other activities. For example, one parent spoke of their two children playing "Minecraft" together during real-world play.

"My kids have lots of Minecraft figures and swords and costumes.... [My older child is] not a kid who does a lot of imaginative play, but... will actually play [real life, imaginary] Minecraft with [the younger sibling], which is very sweet.... They pretend to be ocelots, and... bounce around the house with swords tucked into their jammy bottoms." (Parent 6)

Another mentioned that their child created Microsoft PowerPoint presentations for Minecraft, using these to take parents on tours of Minecraft's virtual spaces.

The most pervasive extension of Minecraft was YouTube. Some youth created YouTube videos—a demonstration of technical and gaming competency—while others played vicariously by watching video of people playing Minecraft.

"[They] have a YouTube channel where [they], commentate as [they're] playing.... [They're] just a totally different person online. It's kind of amazing. Because [they're] so prolific with [their] YouTube videos...." (Parent 4)

“A lot of kids who like Minecraft, they’ll... tell me that they almost like the YouTube channels as much as the actual game.” (ABC Clinic Professional 2)

Noticing how many children in their program enjoyed Minecraft YouTube videos, an ABC Clinic professional created their own YouTube videos in which they use their Minecraft avatar and online creations to discuss therapy topics, such as bullying and anxiety.

5.5. Reasons Clinics Host Minecraft

Generally, we find that parents and clinicians alike believe that Minecraft has qualities that separate it from other games and online experiences, and that the additional measures implemented by clinic servers moderate the remaining potential for harm to their children. The result is a healthy play environment for ND youth. Since they also report that the youth are Minecraft enthusiasts, online play becomes a non-threatening means to engage youth.

Directly addressing RQ1, we find that many of the goals tied to participation in clinical therapy are being realized on the clinic’s Minecraft server.

For our professionals at ABC Clinic, Minecraft was considered a means to excite youth about participating in facility programs. Simply hosting a Minecraft server is seen as an enticement for reluctant youth to engage in other programming.

“If I have an intake meeting now, where I know the kid likes Minecraft, but I know he’s kind of hesitant about the group? I will bring up the Minecraft server. Because that kind of alerts him that, oh, this is kind of cool and more fun. Or, oh, this isn’t just like another therapist.” (ABC Clinic Professional 1)

XYZ Group clients are spread throughout the United States of America. The Minecraft server at XYZ Group was inspired by parental requests for an online space for their geographically separated ND children to socialize, paralleling the online space that had been created for parents to find support:

“People kept saying, ‘oh, there should be a Facebook group for our kids.’ And we’re like, your kids won’t go on Facebook and go to a support group.... But they will play on a Minecraft server. And they will interact on a Minecraft server, and get to know each other. And so we basically created the Minecraft server to be the support group for the kids.” (XYZ Group Professional 1)

ABC Clinic expressed similar goals under the term “community building.” Professionals and parents both believe that joint play is community-building activity. Professionals at ABC Clinic find this sense of community helps youth feel more comfortable participating in other therapeutic programs.

“It’s really nice if they can have sort of conversation points, or just more connection to their peers. And I very much see them excited when they realize that someone in real life is the person that they’ve been interacting with on the game.” (ABC Clinic Professional 1)

Moderated play presents learning opportunities when it comes to developing social skills. Arguments and antisocial behavior (such as destroying others’ work) can be addressed in the moment by moderators. Group activities (such as planned building sessions) can focus on cooperation and communication skills, too.

Minecraft was also preferred over other games because it is seen as creative play.

“And using Minecraft... as an art therapy tool has amazing potential, because it’s just this big blank canvas.” (ABC Clinic Professional 2)

Despite its creative and expressive potential, professionals did not believe that Minecraft experiences would overload their ND players with excessive sensory input.

“[Minecraft is] kind of more predictable and less sensory overload, and less violent, and less loud.... When I see it, it looks more pleasant than if I’m watching [a sci-fi shooting game], and there’s just loud, screeching noises and 20 explosions per second” (ABC Clinic Professional 1)

Also, the structure of Creative Mode is not goal based, allowing for flexibility and playing for a short amount of time. Professionals from both facilities also indicated that Minecraft offered ND children a space and activity in which they could demonstrate their own mastery of a technology, which was a source of self-esteem. While XYZ Group maintained servers 24/7, ABC Group believed its limited hours helped parents and children avoid problems with over-play.

“The parents are seeing more quality of Minecraft play versus quantity.” (ABC Clinic Professional 1)

5.5.1 Organized Moderation Running multiple 24/7 servers, XYZ Group quickly realized a need for expanded moderation. Staff members there have developed a system whereby players can be nominated for a promotion to moderator status based on good online behavior.

“How you become a mod is do good on the server, right? Like, you want to become a moderator? Do good. You’ll get noticed.” (XYZ Group Professional 1)

Nominated players are required to speak with their parents about the role and acquire their permission, attend regular online moderator meetings, and remain on good behavior. Lapses in behavior are not met with instant demotion, but with corrective guidance: the administrator makes it clear that moderator privileges require self-moderation.

As a welcoming social space for ND youth, XYZ Group has also had to deal with players confiding in moderators about impulses toward self-harm. Staff at XYZ Group intend to acquire the services of outside professionals to train moderators on how to handle situations where players confide in them in this manner. Staff at XYZ Group consider player willingness to discuss these sorts of complex, personal feelings as a sign that the server is having its intended effect.

5.6. Value to Parents of Clinics Hosting Minecraft

Specifically addressing RQ2, we find that our parents saw virtue in Minecraft play, though often expressed concepts differently than our professionals. Many of the parents' concerns about online play were expressly mitigated by Minecraft's features or the specifics of the clinic implementations. The presence of moderators gave parents the feeling that these Minecraft servers are "safe places," differentiating them other virtual game spaces.

"[The server] is moderated... and that's brought me a lot of peace. And I've seen [the moderator] intervene and say, you know, we gotta move on. [The moderator] teleports them all to somewhere new and changes the dynamic, so it's very safe. It doesn't mean that there's not inappropriate words that are thrown out there, but [the moderator] addresses it." (Parent 2)

Like professionals, parents believed that displays of Minecraft mastery were a source of self-esteem for their children.

"[School Minecraft club] has been great, because [my child] does have social challenges at school. And [they're] good at Minecraft, and [they know they're] good at it." (Parent 2)

While not expressed as "community building" in the way the professionals spoke, parents also appreciated that their children are forming social bonds with peers.

"There's other people participating over there. So I think, you know, it's kind of like a playdate, almost. You know, it's something on the calendar that he looks forward to." (Parent 5)

Still, parents would like to see more connections established between the children in real-life and online, and want the clinic's assistance to make these connections.

6. Discussion

Themes emerged regarding (1) the qualities of the Minecraft community and environment that lead to engaged social learning; (2) the tensions parents feel

between the desire to give their children opportunities to socialize and their concerns about games and online gaming; and (3) the perceived opportunities and challenges regarding connections between virtual and real-life social behaviors.

6.1. Virtual Environment Scaffolds Social Learning

Both parents and professionals conveyed scenarios where the children expressed social skills in a rich manner, sometimes extending what the children typically exhibit in face-to-face interactions. We applied social learning theory to analyze this phenomenon. What are the affordances of Minecraft that are enabling social learning? Social learning theory bases learning on cooperation, imitation, joint attention, and modeling.

Cooperation was exhibited by constructing a shared virtual environment, such as the richly-developed virtual world of XYZ Group. Cooperative actions were shown, for example:

"[After the online moderator meeting,] we go into the unofficial mod meeting, where everyone stays online and then we do a group project. So right now we're building a player-versus-player arena on the server. So we went in there and we all worked on that. And there's dialogue, and it is complete craziness. And it's really interesting." (XYZ Group Professional 2)

Imitation is enabled as the children observe other avatars and the chat dialog on the hosted server. For example:

"[My child] will build little games that [they've] seen on YouTube, like-- I think [they] call it Sploosh or something, ...where you've got ice under you. And you go around and you hack the ice, and you try to get the other person to fall into the hole." (Parent 4)

Joint attention is required to work together on a building, or calling a sibling's attention to a virtual artifact. For example:

"...They're all excited about something. And I come in, and they're spawning animals. Like, they're making animals. And I'm like, what are you guys doing? It's like, "Oh, look, then a heart will come up. And then you've got two." (Parent 2)

Moderators intentionally model positive behavior and social troubleshooting. Sometimes the modelling is explicit, such as when a moderator and player chat about a social interaction. Other times, modelling is occurring informally, such as when a moderator responds to a player's request for help. The moderator's quick attention to the request, say by teleporting to the player and chatting about their request, models ways to provide assistance through listening and joint attention.

To deepen support for social learning, Minecraft and other online games should evaluate other communication options, such as in-game voice communications. It is technically possible to enable parents and professionals to use alternate in-game communication channels when needed. While there are voice mods, chat worked well for many of the social interactions of the players and moderators. Researchers and practitioners should investigate the balance between adding another communication channel while not overwhelming the sensory and communication processing of ND children. Generally, we believe our findings show there is ample opportunity for the future study of social learning from an information systems perspective, adding to knowledge created in other domains.

6.2. Tensions Between Opportunity and Perceived Harms of Engaging Online

Parents and clinicians facilitated social gameplay towards a common goal of enabling children to extend and deepen their social connections. The parents and therapists noted that these goals are being realized as evidenced by exhibitions of social skills in negotiating their gameplay opportunities and within their gameplay experiences. The benefits of gameplay were apparent as children made meaningful connections, formed positive identities as gamers, and built competency, even to the extent of being the technology expert for their families and peers.

Despite these benefits, parents remained concerned about game play. They worry that their children overplay and will be exposed to Internet threats. It is reasonable that the parents have a general fear about online activity: It is difficult for parents to know exactly what happens online. Parents were not fully aware of their children's game attitudes and behaviors, either, as notably demonstrated by a parent who mistakenly thought their younger child was only playing Minecraft in order to interact with their older sibling, and that any other joint activity would probably serve just as well. That parent later informed us that this perception had been corrected by an older sibling, who reported that the younger sibling really loved Minecraft. There was also an opaqueness to the parent's knowledge about the Minecraft servers, which mods were supported, and when ABC Clinic's server was available.

6.3. Desire to Appropriately Translate Virtual Relationships and Behaviors

Parents and therapists noted both positive and negative social interactions occurring online and are

concerned about the children effectively adjusting to, and navigating, dynamic social norms. In a social game such as Minecraft, moderators are able to facilitate social interactions, although this is limited compared to the deeper facilitation of face-to-face experiences. Possibly outweighing that limitation, however, is the motivation the children have for engaging in a fun, affirming game. They pick up social behaviors via the game and other online games, but these behaviors are not often professionally scrutinized in other online scenarios. Parents primarily seemed to be worried about their children being bullied online, while the professionals also emphasized that unguided online play might normalize antisocial behavior, unintentionally leading to bullying activity on the part of the ND child.

Due to the children's connection to Minecraft, professional facilities are able to rely on Minecraft as a compelling space that the children will return to, if given the right in-game motivations. With this commitment to Minecraft, professionals can support in-the-moment social interventions while facilitating reflection and growth over time. The philosophy of the professionals—such as valuing community formation and giving people the benefit of the doubt—extends from real-life to the game.

7. Limitations

Due to the exploratory nature of our study, we have a sample that is local to our geographic area and with which we had connections. Participating parents all had the economic means to pay for the services of the facilities in the study. Parents opting not to allow their children to participate in Minecraft offerings were not identified and interviewed, skewing our results toward positive experiences. We chose to interview the technology providers, rather than engage directly with the ND youth, in order to understand the overarching goals and context for gameplay. We hope this study can inform subsequent participatory research with ND youth, perhaps virtually through game play or in-person through observations and co-design activities.

8. Conclusion

Our exploratory study yielded rich descriptions of the experiences and practices of social lives and gaming of ND children. Social skills are a core component of a ND diagnosis and lived experience, as evidenced by the challenges faced by the children and the referrals from schools to social skills therapy. The popularity of Minecraft among children of all abilities provides a compelling, motivating environment for

parents and clinicians to support their mutual goal of building the children's social skills and relationships.

We found that although parents observed social growth on Minecraft, they retained reservations about the influence of games and online environments on their children. Parents and therapists desired that the youth to have more robust connections between their positive virtual and face-to-face social connections. Based on our findings to date, families and neurodiverse programs that currently do not incorporate online gaming, particularly pro-social games such as Minecraft, should be encouraged to do so. System designers and administrators should enrich platform features that facilitate social learning. Such gaming platforms, with their affordances for social learning, motivate the youth to engage in the ups and downs of social learning and reap the benefits of a supportive, safe community.

9. References

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