

Minecraft as a tool for engaging children with autism with science

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Science Hunters ([www.lancaster.ac.uk/sciencehunters](http://www.lancaster.ac.uk/sciencehunters)) is an outreach project, based at Lancaster University, which uses the computer game Minecraft (<http://minecraft.net>) to engage children with learning about science. This approach naturally entices them to engage by using a medium which is familiar and appealing. Children can become fully immersed in the topic, exploring it in the game, and can communicate with each other in both the virtual and real worlds through collaborative building. The project has a primary focus on working with children who may face barriers to accessing Higher Education and both inspiring an interest in science and instilling the ethos that science and research are accessible to everyone. A key element of the project is extensive work with children with Autism Spectrum Disorder (ASD). ASD is a developmental disorder characterised by impairments in social interaction and communication, repetitive behaviours, and restricted interests<sup>1</sup>. Children with ASD often have difficulty communicating and engaging in “real world” social interactions, and restricted interests can present barriers to children’s motivation to engage with others and interventions. Minecraft provides a social context that allows children to practise initiating and responding to communication, cooperation, pretend play, adherence to social norms, and relationship building. An important aspect of the Science Hunters project is an inclusive, relaxed environment in which to engage and support children (with ASD or otherwise) with both access to and perceptions of science, and improved senses of wellbeing and social inclusion.

## **Minecraft as an educational tool**

Children's interests in science tend to decline from 10 years of age<sup>2</sup> and are usually established by 14 years<sup>3</sup>. However, this decline in interest can be counteracted by engaging children in practical, investigative, activities associated with science<sup>4</sup>. Thus, identifying and developing effective methods of encouraging young people to engage with science are of paramount importance<sup>5</sup>.

In the UK, 69% of 6–10 year olds and 81% of 11–14 year olds play video games<sup>6</sup>. Minecraft is one such game, which is highly popular (within five years of release it was the second-best selling game of all time<sup>7</sup>) and has been described as one of the most important computer games of the current generation<sup>8</sup>. With features which correspond to real-world processes and relevance to a variety of natural and physical sciences, it is also an ideal medium for communication of scientific concepts<sup>8,9</sup>.

Minecraft is a construction-based, open-world game in which players can move freely around, placing and breaking blocks which have a wide range of appearances and properties to build an almost infinite range of constructions. Children become immersed in the game and can explore concepts in ways which are simply not feasible in the real world, such as erupting a volcano and determining which materials best protect a house from advancing lava<sup>10,11</sup>, or experimenting with different methods to encourage crop growth<sup>12</sup> – all within the timeframe of a lesson. This level and scope of engagement enables in-depth investigation of topics and facilitates consolidation of learning through practical application and enjoyment of science through the gameplay delivery<sup>10,11,12</sup>. The game is relatively simple, affordable and accessible enabling active construction of knowledge, teamworking and interaction, and rendering the game a viable option for use in the classroom<sup>13</sup>. Detailed descriptions of Minecraft's features and its use in a range of formal educational settings can be found elsewhere<sup>8,13</sup>, including application of the game in arts, physics, chemistry, geology, computing, and social skills education.

## **Benefits of Minecraft for children with Autism Spectrum Disorder (ASD)**

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterised by profound impairments in communication and interaction —often resulting in difficulty engaging in “real life” social situations<sup>1</sup>. Engagement is recognised as critical for learning in children with and without disabilities, and for effective interventions for children with ASD<sup>14</sup>. The relatively high preference (compared to people without ASD<sup>15</sup>) of many people with ASD for electronic screen media over other leisure activities supports incorporation of such media into learning strategies for children with ASD<sup>16</sup>. Minecraft is a shared interest of many children with ASD, and countless anecdotal reports suggest that the social-interactive aspect of Minecraft has great benefits for children’s confidence, social motivation, and communication skills<sup>11</sup>. As such, children with ASD can be hugely experienced with Minecraft, giving them a sense of expertise and ownership<sup>11</sup>. The game has the option to either function as a single-player game, or operate in a way that allows children to use shared virtual worlds in which they can interact and communicate with each other. Players can safely communicate and play together through these secure shared servers; online communities such as this provide alternative spaces for communication which are particularly valuable for people with autism who may find face-to-face interactions challenging<sup>17,18</sup>. Minecraft, as a select interest for many children with ASD, thus provides a unique platform for introducing and engaging children with topics that do not interest them when presented through “traditional” means. Appropriate use of the game in learning contexts also offers opportunities to practise ‘joint engagement’ (simultaneous interaction with people and materials) which requires coordination of attention and social transactions, skills which children with ASD may particularly benefit from developing<sup>14</sup>. Science Hunters uses an educational version of Minecraft, ensuring a safe play environment, and operates the game in its ‘creative’ mode which allows unlimited blocks for creative building. Sessions take place in both formal, non-formal and informal learning settings, with the same essential approach employed in all.

## **Pedagogical approach**

The project delivers content through a learner-centred constructivist approach<sup>19,20</sup> based on anchored instruction<sup>21</sup> and constructionism<sup>22</sup>. This is facilitated by the accessibility of Minecraft<sup>13</sup> and its support of transformational play<sup>23</sup> by allowing interaction with and alteration of the virtual world and creation of almost any item<sup>13</sup>. Inquiry-based learning is supported as children develop their understanding through their own endeavours and in collaboration with others, typically working in groups of 15 or fewer children. While these strategies are used with all groups the project work with, there are known positive impacts of structured instruction during independent play and cooperative learning on engagement for children with ASD in particular, especially within small groups<sup>14</sup>.

Scientific topics are presented via interactive, hands-on introductions, with related Minecraft tasks and challenges then set<sup>10,11,12</sup>. Children are free to choose their own approach to these tasks, based on aspects of the topics which most interest or inspire them, with support and guidance from session staff. There is a deliberate and clear emphasis on supporting children to find and maintain interest in, and understanding of, scientific topics. The sessions enable children to feel a sense of ownership and that science is 'for them', whilst consolidating their learning<sup>10,11,12</sup>. This is particularly relevant for children with ASD, who often develop 'special interests'<sup>24</sup>. Such interests should be valued and can lead to improvements in children's social, communication, emotional and other skills<sup>24</sup>; this approach allows any particular interests, either pre-existing or that arise within the sessions, to be nurtured and followed without the need to follow a set or pre-determined session structure.

## **Diversity and flexibility**

Overall, Science Hunters sessions are set up to have an ethos of inclusion, tolerance and flexibility whilst using Minecraft to engage children with learning about science. Differences in age, needs, abilities, experience with Minecraft, language skills and other factors are not problematic within a

flexible and inclusive structure, and can foster a culture of 'helping each other' between participants which encourages real-world social engagement and friendship building. Session staff are representative of a wide range of backgrounds and aware of differing needs. In this context, positive associations with science and scientists can be created. Adults known to children are always present in order to provide security and specific behaviour management intervention and support should it be needed.

With science learning as a core focus, participation can also lead to social benefits for children. For example, in extra-curricular settings parents/carers frequently report that Science Hunters Minecraft Clubs are the only extra-curricular activity that their children with ASD will participate in, and in formal education settings teachers express that the structure and gameplay element of Minecraft appeal to their students with ASD<sup>25</sup>. This is an approach which is replicable in a number of settings, including school Minecraft Clubs, which the project has supported in a number of cases and sees as a key area for future progress.

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## **Authors**

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