

# Digital Manufacturing Education Using Minecraft

— The Minecraft Cup —



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## 1. What is the Minecraft Cup?

We have been holding a “National Minecraft Cup Contest” to create worlds using the Education Edition of Minecraft since 2019. In this contest, we give children a different theme each year, and they build and publish a world in Minecraft. For the 3rd national contest, the Minecraft Cup 2021, our theme was “Future communities and homes for the age of SDGs.”

Figure 1: Educational effects of using Minecraft



Minecraft is generally thought of as a game, but it has the highest sales in the world, with over 200 million units sold, and it has incredible recognition among children. But actually, Minecraft is also used in educational settings. It is used in various ways, such as having all class members work together to build a structure and publish it, or to learn programming within Minecraft. We think of Minecraft not as a game, but as a digital manufacturing platform. In this tournament, it is used as a platform for demonstrating participants’ powers of imagination and creativity.

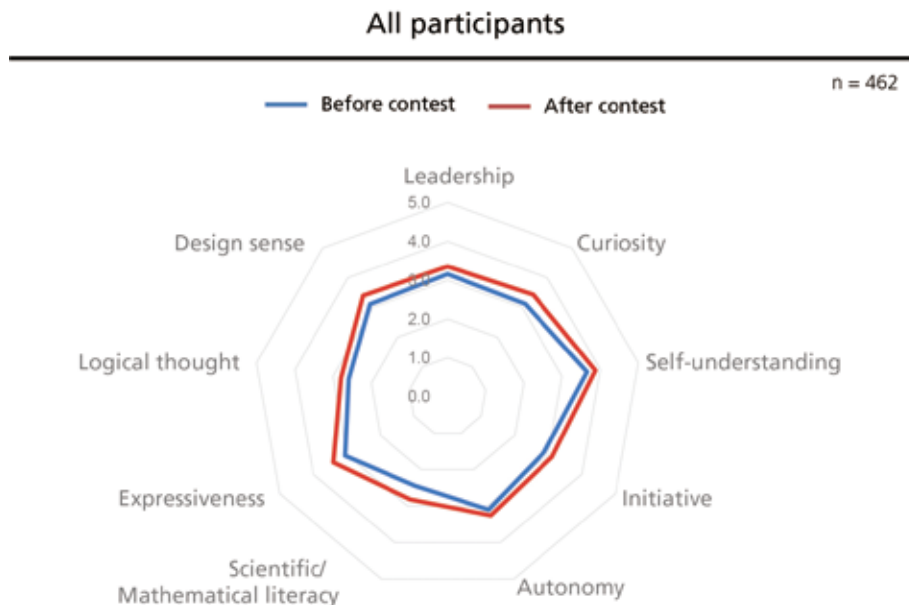
As they play, children develop abilities such as those shown in Figure 3. They become interested in studying the theme given for the contest and their creativity is sparked, considering what blocks and what kind of arrangement can be used to represent a community or a home. They also use programming approaches to build circuits that operate using power, and they develop cooperative skills as they play with their friends and classmates.

For the Minecraft Cup, participants are evaluated using a rubric. Nine indices for “next-generation personnel” are used, evaluating based on five levels. These are used before and after participating in the contest to study how the children’s abilities

Figure 2: Evaluation rubric: Definition of evaluation items and levels

		Next-generation personnel People able to define practical problems and with the attitude, capability and skills to move independently from concept to execution.													
凡例: 今回の調査で採用した指標		指標			課題解決の基礎となる力		課題設定を行い、解決策を構築していく力		課題の解決策を実行していく力						
		自分事化	好奇心	他己理解	自己理解	自己意見明確化	勇気	自律心	持続的 自己管理	読解力	観察力	本質的思考	論理的思考	人材育成力	モノづくり (創造力)
		向上心		シナジー創出				失敗を恐れぬ姿勢		科学・数学的リテラシー		デザイン思考			マネジメント力
到達レベル	Level 5	世の中の出来事に興味を持ち、自ら変化を起こそうとする姿勢	多様な価値を理解し、違いを尊重しながら、協力して成果を出す姿勢	自分としての考えを持ち、積極的に発信していく姿勢	答えがないことであっても恐れず、最後までやりとげる姿勢	課題解決の基礎となる力	課題設定を行い、解決策を構築していく力	課題の解決策を実行していく力	学校や家庭以外の世の中で何が問題になっているのかを考え、自分ができることを発見し、自分からすすんで行動する	文化や育った環境が違う人（他の国の人や大人など）と活動していて、自分と異なる意見が出たとき、その意見が出た理由や考え方を理解しようとする	他の人の考えや行動に変化をもたらそうと、仲間や社会に対して、自分の意見を正確に発信しようとする	課題に負けずともたても、自分の目標達成に向けて、自分の定めたルールに従って行動することができる	様々な問題に対して、人々の心や記憶に強く残るような表現をし、感動させることができる	順序立てて物事を考え、多くの人が納得できる解決策を導き出すことができる	学校外の活動で、詳細な活動計画を立て、予想外のことが起きても計画を修正しながら、予定通りに活動を進めることができる
	Level 4	用活動や休活動で、自分ができることや、するべきことを考え、物の人に言われる前に自分から行動する	用活動や休活動で、他人が自分と違う意見を持っていることも、受け止めることができる	自分の得意分野であれば、不特定多数の人の前で発表ができる（読書感想文や弁論大会に参加など）	周りの応援や圧力をバネにして、自分で決めた目標に向かって行動しようとする	コンテストや大会などで、自分考えたことや感じたことを言葉や絵、歌やダンス、映画、プログラミングなど何らかしらの形で自分を表現し、審査員に伝えられる	学級活動や部活動、委員会などで、詳細な活動計画を立て、予想外のことが起きれば、予定通りに活動を進めることができる								
	Level 3	未来から送られた課題や宿題、おうちの人が頼まれるにお手伝いなどは、とろあえずやる	同じクラスの人に対して、どんなことが好きで、どんなことが嫌いなのかの知識があると関心する	先生や親から意見を求められるから、自分の意見を言う	お小遣いをもらって家事を手伝うなど、自分にとって明確なメリットがあれば、アクションをとることができる	家族や友人など、自分のことや興味があることについて、言葉で伝えたり、何らかの形で表現し、伝えようとする	複雑な物事に対して、自分なりに理由を考え、説明することができる	自分が今日、明日でやるべきことを決めることができる							
	Level 2	用活動や休活動で、自分ができることや、するべきことを考え、物の人に言われる前に自分から行動する	用活動や休活動で、他人が自分と違う意見を持っていることも、受け止めることができる	自分の得意分野であれば、不特定多数の人の前で発表ができる（読書感想文や弁論大会に参加など）	周りの応援や圧力をバネにして、自分で決めた目標に向かって行動しようとする	コンテストや大会などで、自分考えたことや感じたことを言葉や絵、歌やダンス、映画、プログラミングなど何らかしらの形で自分を表現し、審査員に伝えられる	学級活動や部活動、委員会などで、詳細な活動計画を立て、予想外のことが起きれば、予定通りに活動を進めることができる								
	Level 1	用活動や休活動で、自分ができることや、するべきことを考え、物の人に言われる前に自分から行動する	用活動や休活動で、他人が自分と違う意見を持っていることも、受け止めることができる	自分の得意分野であれば、不特定多数の人の前で発表ができる（読書感想文や弁論大会に参加など）	周りの応援や圧力をバネにして、自分で決めた目標に向かって行動しようとする	コンテストや大会などで、自分考えたことや感じたことを言葉や絵、歌やダンス、映画、プログラミングなど何らかしらの形で自分を表現し、審査員に伝えられる	学級活動や部活動、委員会などで、詳細な活動計画を立て、予想外のことが起きれば、予定通りに活動を進めることができる								

■ Figure 3: Changes in participants



may have improved.

The results showed that before and after participating in the contest, skills such as science and mathematics literacy, expressiveness and design sense improved, and their curiosity generally increased. Detailed results are available on our web page for those who are interested.

## 2. Why is the Minecraft Cup held?

We are not engaged in this activity to nurture Minecraft specialists, or promote game sales. Our objective is to provide opportunities for all children, to learn to identify and solve problems using programming and digital manufacturing, and to build a learning community where they can learn together. To achieve this, we are expanding our activities in collaboration with Microsoft Certified Education Innovator teachers, who are promoting ICT education in classrooms throughout Japan.

We often use the national high-school baseball championships at Koshien as an example to describe our activities. I did not belong to a baseball club, and not every child that starts playing baseball is aiming to reach Koshien, but children learn many things from baseball. Most players will not make it to Koshien. Even so, there are great battles at regional tournaments and even today, games happening in various locations that we do not know about. Children make friends through baseball, strengthen their minds and bodies, and form connections with society. They connect with other players, and also with coaches, teachers, and others' parents who support them. Our objective is to build a digital manufacturing community through Minecraft, similar to the sports community built around baseball.

Throughout Japan, there already were many independent

communities such as programming classes and personal computer clubs in schools. In operation of this tournament, these types of organization have felt the potential of this contest and worked on building submissions. In running the contest, our biggest obstacle was insufficient understanding from parents and school teachers. Parents and teachers would praise a child who was enthusiastic about baseball; even if that was all they did, but if they were obsessed with Minecraft, generally they would be scolded or even have their game taken away. As is true with anything, playing too much baseball can result in a shoulder injury for example, and Minecraft is no different. One cannot achieve results simply by spending large amounts of time. We feel that there is a striking lack of initiatives that create opportunities for children to show their efforts in digital education and to receive praise from friends and family who support and encourage them. As such, we are working to raise awareness of children involved in digital manufacturing and the adults who are supporting them, and holding this contest is part of that effort.

In particular, we are promoting the contest by sending contest information to education committees in cities, towns and villages all over Japan through ICT CONNECT 21, an organization that promotes digital education. We also have PR activities such as engaging popular YouTubers as judges, using video to promote it, and advertising in magazines from the editorial department of Corocoro Comics, which is one of our media partners. Even with these measures, it was also necessary to have parents and teachers encouraging students to get their participation. We have had more participants each year, but when we asked what prompted them to apply, the most common answer was that their school teacher suggested it. Initially, most of the applicants were

children who became interested because of another activity such as a programming class, but this base really seems to be expanding. By reducing obstacles to participating and creating more opportunities to publish participants' creations, we want to create a culture that encourages children to try digital manufacturing.

### 3. Real Event: Taragi Minecraft workshop

In addition to operating contests, we are also creating opportunities by holding events such as workshops. For example, in Taragi, a town of 9,000 people in the Kuma district of Kumamoto Prefecture, we collaborated with a local organization called the Taragi Community-building Promotion Agency to hold the "Taragi Minecraft Workshop" in March, 2021.

The workshop was held over three days, and involved studying cultural properties and buildings in the region and then building a world in Minecraft that reproduces them, as an introduction to the town. 23 students from elementary schools in the town participated. The children started with a tour of the town, during which they heard explanations about the size of buildings and

what materials they were made of from their guide, and they took notes enthusiastically on their tablets.

As its name indicates, the town of Taragi is known for having good timber. The Shiiba branch manager of Kumamoto Mokuzaï

■ Figure 6: Wood, a local resource



■ Figure 4: Taragi workshop



■ Figure 7: Building with Minecraft



■ Figure 5: Fieldwork at Otake family residence



■ Figure 8: Design drawing of buildings being recreated



(a local timber company) provided a chance for the children to see and touch some real wood. In Minecraft, it is easy to obtain wood, but in the workshop, they were able to smell and touch it, and gained a sense of the effort required to process real wood.

Next, they began building their creations, in teams of three participants. Minecraft worlds are composed of blocks that are approximately 1 m in each direction. In their teams, participants collaborated, drawing design diagrams, selecting materials to use, and building their world. Although some teams had conflict or became distracted, they all worked together enthusiastically. Teachers who came to observe were surprised to see the enthusiasm in the children's eyes as they worked.

On the final day, we held presentations of each of the completed projects. The mayor of Taragi attended as a guest, and watched all of the presentations. He commented that this digital education was nothing like what he had imagined and that all of the projects were wonderful.

Our impression after a series of workshops is that, beyond the children that participated, the parents, teachers, and the mayor who watched the presentations really got a sense of the children's potential. One elementary school principal that attended the

■ **Figure 9: Recreating Ebisu Plaza, Ishikura Community Center**



presentations immediately decided to integrate Minecraft into classes. Currently, all grade six students at that school have lessons using Minecraft throughout the year. We feel that we can advance digital education by gradually expanding this type of activity throughout Japan. Starting this fiscal year, we have decided to conduct judging in separate regional blocks.

#### 4. Online workshop connecting all of Japan

For the Minecraft Cup, we held qualifying contests dividing the country into five regional blocks. This enabled us to increase the number of announcements in each region in hopes of stimulating activity in the community. Initially, we intended to hold many events in each region, but a state of emergency and other measures to prevent spread of infection were instituted due to COVID-19, so we were unable to hold most of them.

As such, we collaborated with teachers in charge of each regional block, holding hybrid workshops and seminars. Participants gathered at real locations in regions where a venue could be arranged and online where that was not possible. The venues were connected with each other using Microsoft Teams, and children all over Japan were able to attend classes together.

In one class, a top-class Minecrafter called Hizume joined as a guest, and explained how to recreate real houses in Minecraft. Children from all of Japan were able to watch the video and also able to see each others' facial expressions and reactions as the class progressed, providing a deeper learning experience.

#### 5. Online promotion conceived with partner companies

We worked with partner companies to plan online promotion for this contest. In an online dialogue held jointly with our Gold Partner, Sekisui House Ltd., professional Minecrafter, Shuichi Tatsunami, visited the latest residences and showed how he had

■ **Figure 10: Minecraft Cup regional workshop**



■ Figure 11: Online dialogue with pro-minecrafter, Shuichi Tatsunami



recreated them in Minecraft. Various techniques are used in these latest homes, such as how to install solar panels and designing floor plans to create space for each room, which conveyed a real sense of the connection between Minecraft worlds and real home building.

We also planned online promotions together with Silver Partner companies, Mitsubishi Estate Co. Ltd. and Norinchukin Bank. In collaboration with these two companies, who are working on community building and the agriculture, forestry and fisheries industries for the future, we sent promotions from the center of Tokyo Station to all of Japan. This promotion gave a real sense of the connection between worlds conceived in Minecraft and the real world, and how good-quality input is necessary to produce creative expression. This initiatives show how very important our partnerships with these companies are.

## 6. Support classes for special support bases

One of our objectives is to “maximize the possibilities of all children.” To begin using Minecraft requires a personal computer and internet environment. There are also some children that cannot be reached through schools or programming classes, and other children who cannot go to school for various reasons. We are working to create learning environments using Minecraft for these children. This year, together with one of our advisors, Yasushi Aoto, who is also Director of the Council of Organizations supporting education and children in need throughout Japan, we provided equipment and held online workshops for children attending Saitama Youth Support Net. Many children having difficulty with self-expression are able to demonstrate their own abilities on Minecraft. We hope that by creating a cycle in which older members can teach younger members in classes using Minecraft, our efforts will be able to expand further.

## 7. Why did I start working on Minecraft Cup?

Besides working on this contest, I am also working on regional community building. In 2015, I moved from Tokyo to an island in

Kagoshima Prefecture called Nagashima-cho, with a population of 10,000, and I have been working on services and plans to solve regional issues using ICT. Previously I worked at an IT services enterprise. In my activities in the region, I realized that there are still issues that can be resolved using digital technology. However, people to take on these issues were not being cultivated in the region, and were leaving the area for the cities. It was clear that compared to cities, there are few opportunities to be involved with ICT in such localities. With the GIGA School initiative, a PC will be provided to all students in Japan, but there are still people who will not know what to do with it. With aging and shrinking population of Japan, schools are also being reorganized so that, as with other clubs such as baseball or ballet, the number of available choices is decreasing. The number of children leaving the community to go to university is also increasing, possibly related to these conditions. In the town where I am, the only high school was closed more than ten years ago. In 2016, I began collaborating with an internet distance-education high-school, attempting to create mechanisms for students to attend high school even from communities that have no school. However, the project did not go well because we could not get adequate understanding from the students or their parents. What I learned from this was that rather than just a learning environment, what is needed is content that is enjoyable to learn.

Amid these circumstances, we began discussion to establish the Minecraft Cup in 2019, and I became the director of the project. Digital manufacturing is not confined to a location. Anyone, anywhere and at any time can connect. We feel that this is more important for the expansion of this project than producing any one specialist.

There is much more we want to do in the future, such as operating a national tour, and holding more regional workshops. I hope that if anyone reading this article is interested, they will not hesitate to try Minecraft, and to encourage children to do so as well.