NANOWARE Minecraft Worlds

GUIDE FOR EDUCATORS

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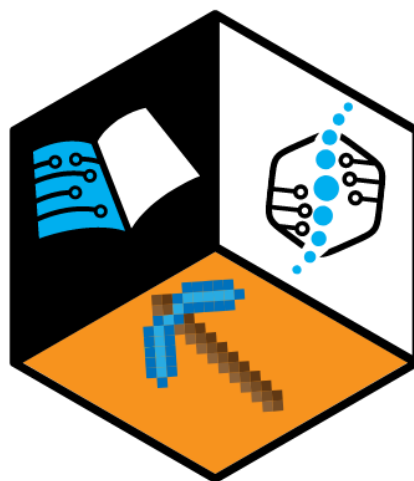
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Contents

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1. Overview – STEM and Minecraft Education in schools

Nanotechnology materials are being utilized in our daily lives in many ways, often without consumer knowledge. Due to the explosion of nanotechnology applications, there is a necessity to update school science curricula by integrating nanotechnology-related concepts that are both relevant and meaningful to students.

As the greatest influence in your child's life, parents can talk about STEM, can encourage expose the child to Nanoscience activities and Minecraft resources outside of school. The Educator Guide is one of those resources that everyone can use to assist with educating the children.

The purpose of this Educator guide (Parent's guide & Teacher's pack) is to cultivate teachers' capacity to teach new technology, to enhance students' interests and understanding of basic science, and to produce innovations in learning of STEM. Therefore, this guide is a valuable resource for those who want to create a more solid Minecraft Education by providing both a theoretical and a pedagogical framework for STEM.

We believe that by using this guide, educators and parents can grow children as problem solvers and critical thinkers, inspiring creative, inclusive learning through play. Exploring our resources, you'll be able to create a vision for European STEM education in general.

Teachers will have the opportunity to explore Nanoscience methodologies to support student-centric activities in research and discovery learning. In addition, students will transfer STEM skills to understand the importance of nanotechnology in society using Minecraft resources.

School systems have a responsibility to enable young people with a fundamental level of STEM literacy, to facilitate STEM engagement through effective curriculum. **STEM curriculum** will be science concepts, principles, and theories, **STEM pedagogy** will be engineering and technology using the engineering design process which requires children to solve real-world problems, teaching approaches and assessment resources to improve learning outcomes in the classroom.

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1.1 What are the challenges in STEM teaching?

In the STEM framework, particularly about the curriculum:

- Teachers believe that including engineering with mathematics and science builds the problem-solving skills of children
- Teachers need to integrate subjects such as Minecraft or Nanoscience
- Children need lots of practice participating in group work and learning by doing

STEM Curriculum is based on the following PRINCIPLES:

STEM CURRICULUM IS INCLUSIVE AND ACCESSIBLE	QUALITY AND RIGOUR	RELEVANCE AND AUTHENTICITY
• makes connections between current and future learning and career pathways • provides access and challenge for all learners • develops insights into the relevance of STEM in society and the world of work	• allows for team teaching, scheduling of regular meetings for the STEM team • encourages working with staff, students and parents to establish a shared understanding of STEM	• apply and integrate the knowledge from each of the STEM learning areas by providing challenge for all learners • use real-world challenges by enabling students to develop as self-directed and lifelong learners

Fig. 1 Principles of STEM Curriculum

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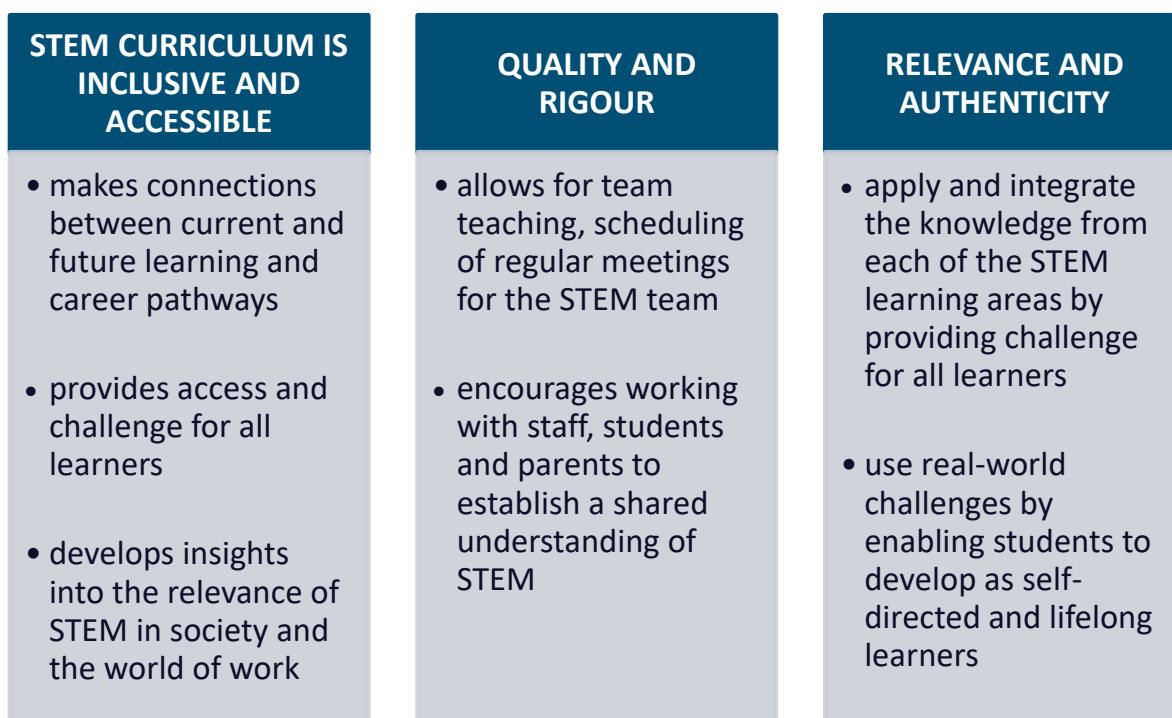
Learning pathways means for EDUCATORS:

- Inspiring students about possible futures in STEM-related fields and making connections between their current and future learning and potential career pathways
- Active STEM as a path to learning
- Encouragement of a growth mindset learning
- Pair programming
- Building from concrete to abstract
- Improving the integration of statistical concepts, data analysis and problem-solving skills into school programs
- Encourage teachers to prioritize STEM content knowledge.

The STEM Curriculum can demonstrate an integrated learning approach, and establish STEM learning pathways:

- to link school learning to future study and work opportunities
- to identify and consolidate connections between learning areas
- to be very engaging for both students and teachers
- to develop students' ability to collaborate with others
- to improve students' ability to communicate ideas
- to deliver content from STEM disciplines throughout the life
- to provide a rich context for learning and developing the general capabilities for 21st-century learning
- to improve students' ability to transfer knowledge and skills from one learning area to other contexts.

Students could learn transferable skills responding to the challenges of the complex environmental, social and economic pressures of this century; young people may be required to be creative, innovative, enterprising and adaptable, with the motivation, confidence and skills to use critical and creative thinking purposefully.

1.2 Why is STEM important for all students?

The STEM curriculum fosters the development of critical and creative thinking general capability as learners imagine, generate, develop and critically evaluate ideas. Students will learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are integral to activities that require learners to use imagination and innovation in all learning areas at school and in their lives beyond school.

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Design thinking, problem-solving and inquiry are key ways that STEM challenges are addressed through an iterative cycle to develop, test and refine solutions. Design solutions may be in the form of a product, service or STEM environment.

Learners will use strategies for understanding design problems and opportunities, visualizing and generating creative and innovative ideas, and analysing and evaluating those ideas that best meet the criteria for success and planning through the process. Essentially it involves:

- investigating and defining
- generating and designing
- producing and implementing
- collaborating and managing to create a designed solution
- evaluating

Fig. 2 Responding to the challenges of STEM

Teachers need to involve their students to analyze problems, refine concepts and reflect on the decision-making process by engaging in systems, design and computational thinking and also to identify, explore and clarify information in a range of situations.

Students will learn to consider how data, information, systems, materials, tools and equipment (past and present) will impact their lives, and how these elements might be better designed and managed. Learners will build their visual and spatial thinking and will create STEM solutions, experimenting, drawing, modelling, designing and working with digital tools, equipment and software.
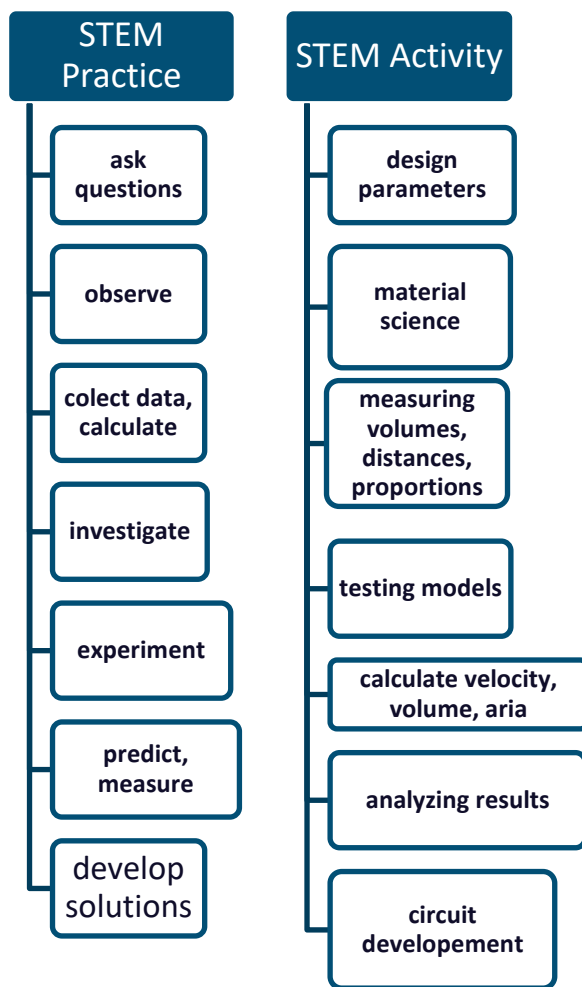
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STEM Practice

- ask questions
- observe
- colect data, calculate
- investigate
- experiment
- predict, measure
- develop solutions

STEM Activity

- design parameters
- material science
- measuring volumes, distances, proportions
- testing models
- calculate velocity, volume, aria
- analyzing results
- circuit developement

Fig. 3 STEM Practice & Activities

- Technology can be a tool for learning,
- Technology should be used to increase access to learning opportunities for all children.
- Technology may be used to strengthen relationships among parents, families, early
- educators, and young children.
- Technology is more effective for learning when adults and peers interact or co-view with

young children.

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2. Integrated STEM teaching

STEM Lessons are created to invite students to explore science, technology, engineering, math, outdoor gardens, and literacy as a thematic unit. Students become experts in a piece of equipment and teach this to the rest of the class.

The STEM curriculum investigates real-world questions and refers to activities which focus on generating designed solutions for future needs and opportunities; students will develop computational thinking and programming skills to devise digital solutions. In the context of a STEM challenge, digital technologies will be integrated with Science, Mathematics and Technologies.

Learn the scientific method and successfully complete a scientific method quiz.

Develop their own testable question.

Learn to keep a detailed scientific journal.

Learn the equipment found in the STEM lab.
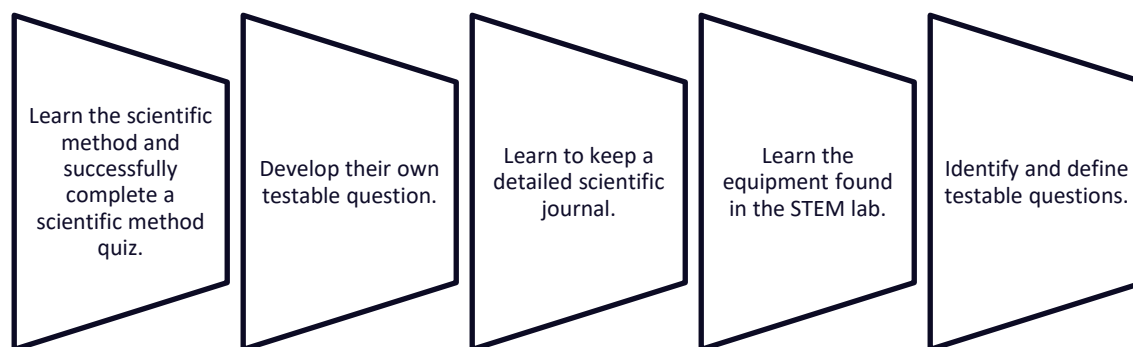
Identify and define testable questions.

Fig. 4 Student STEM Objectives

After completing the STEM curriculum, students will become familiar with programming basics, algorithms, logical reasoning, and coding activities. Students will be able to understand the basics of robotics, and algorithms, with the help of a wide variety of hands-on activities, selecting appropriate simulations, or projecting possible viewpoints, variables, applicable data sets and formats.

Students have to formulate an issue hypothesis, review literature as primary reading sources, differentiate between subjective/objective data and their usefulness to the issue, or examine applicable existent surveys, impact studies, or models.

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For a research plan, students can use:

- Variables (independent, dependent, controlled for a controlled experiment)
- Materials needed to conduct their project taking into account
- Cost
- Availability of resources in school and/or community, following safety rules and procedures

Students can develop the following STEM activities:

- evaluate web resources
- differentiate resources and understand when to use each type
- summarize, analyze and reflect on scientific investigation
- develop their research plan and share it with their peers
- develop their complete experimental procedure, begin experimenting in the lab
- organize, graph, discuss and statistically analyze the data
- write their conclusion and debate
- prepare an oral presentation that summarizes their research; the presentation will use a digital presentation program (PowerPoint, Keynote, Google Presentation etc…)
- find the relevant computational formulas
- compare the recorded data to determine the grade level for the inclusion of the topic
- present their work to their peers, teacher and community (at competitions, at the regional science fair)
- apply the concepts, principles, and processes of scientific inquiry.

Some examples showcase areas of study and the fields they connect:

- medical advances and the manufacturing of medications combine biology and engineering with economic and ethical considerations
- the creation and distribution of vaccines can be used to combine biology with economic considerations, geography, and social studies
- climate change will involve physics, and mathematics, and pair them with ethical and economic considerations
- the use of animals in scientific research will require students to explore biology, engineering, and ethics.

The assessment has to include:

- Class presentations
- Online discussion forum
- A logical conclusion based on the data will be drawn.
- Various competitions.

3. Tips for educators to make STEM part of the classroom

These tips suggest that without adapting inquiry-based, student-centred, skill-driven approaches to teaching and learning, STEM education will become just another term to work additional math or science curriculum. Both teachers and students must work together so they can shape the problem-solving process. As an educational tool, Minecraft Education offers a unique and immersive learning experience that can engage and inspire your child's curiosity, creativity, and critical thinking skills.

How to do so?

Teach knowing and doing. For this is important that we understand that learning needs a propose. Students need to engage in activities where they can create products, not just take tests. Those products should be exhibited to their peers, teachers, parents, and adult experts. Teachers can get better results by using the cycle of inquiry to stress continual reflection and refinement of the product. This requires an intentional assessment tool like a design rubric or reflection form that is graded.

Start with questions. Any important results in science, engineering, or technology start with a question. An engaging, rigorous STEM curriculum emphasizes. A STEM program can teach facts and information -- these are essential to young people. But make sure that students are constantly challenged by interesting, meaningful questions -- with potential answers that matter to the world.

Allow for creativity. To allow students to enhance their creativity, teachers will need to rethink their curriculum and allow some experimentation and, for instance, incorporate a creativity rubric into their projects. Teachers can think about creating a category inside their projects that is open-ended, in such a way that students can think of outside-the-box solutions to the problems or situations they are working on.

Make teamwork central. A lot of today's jobs require teamwork skills. To help students identify the exact tasks associated with 21st-century teamwork and develop these skills, teachers can promote teamwork during the STEM class moments.

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The best and easiest way to implement STEM is to start small, choosing a topic that you are familiar with and modifying it a little so it becomes a problem or a question for students to solve.

- Formulate a research question that is testable and measurable, testing applicable simulation models, or completing all data collection requirements.
- Write a research question that is practical and considers time, cost and instrumentation availability.
- Establish a STEM professional learning exchange, in partnership with universities.
- Encourage the uptake of online learning materials, linked to classroom practice, to support the development of students' problem-solving and reasoning skills which are at the core of mathematical thinking, scientific literacy and a deep engagement with coding.
- Use coding to develop mathematical thinking and solve real-world problems.
- Design applicable survey and interview instruments and methodologies.
- Conduct issue investigation (following all procedural and safety precautions), interviewing associated entities or experts.
- Interpret and analyze results to produce findings and issue resolution options, evaluating validity and reliability, deductions, and perceptions.
- Formulate proposals for innovative technological design, generating ideas for innovations and tools, materials, or researching applicable scientific principles or concepts.
- Design safety, available technology and equipment to collect and record data accurately.
- Design a solution proposal about variables.
- Interpret and represent results of analysis to produce findings, comparing data sets to design solutions.
- Report the process and results of a design investigation, communicating quantitative observations, and analyzing a logical explanation of success or errors.
- Procedure will be organized into presentations to share with the class.

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4. Tips for parents to use STEM

Kids develop STEM habits in the classroom, but they spend most of their time outside of school. That's where parents and other adults can help to inspire, support, and continue their children's STEM learning. It is important to understand that technology is a tool – a means of more efficiently and effectively achieving the ultimate goal of improving child outcomes. STEM is a great opportunity to support children's development.

Curiosity and Initiative	•Children explore the environment with an increased focus on ways to learn about people, things, materials, and events
Observation and Investigation	•Children observe and investigate and events in the environment to develop new knowledge and spark new interest
Making prediction and risk-taking	•Children are encouraged to make predictions at the beginning of STEM activities on what they think might happen
Experimenting and Task Analysis	•Children are provided with opportunities to formulate ideas, test them, and coming up with conclusions
Engagement and Attention	•Children's interests are sparked by our interactive activities even if they are challenging or difficult
Creativity	•Children will be engage in creative play and express themselves in different ways
Problem-Solving	•Children will construct knowledge by making mistakes and coming up with ways to solve problems
Invention	•Children will formulate and explore ideas and develop creativity
Exploration and Play	•Children will learn from each other, will explore their environment
Making Connection	•Children will connect with the world through exploration, self-discovery, and nature

Fig. 5 Tips for parents to use STEM

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- **Talk with the child about Nanotechnology**

For example, talk about gravity when the child what nanoparticles are, how to identify them, and describe some of their properties and uses.

- **Encourage curiosity and questioning**

Display curiosity about Minecraft learning or the recent advances in nanotechnology. Parent enthusiasm may be the greatest motivator for a child's interest in STEM. When your child asks a question, encourage him/her to research information and come up with several possible solutions for a problem. Ask your child questions as well, to inspire further conversations.

- **Encourage your child to think like an engineer**

Help kids understand that there are many solutions to a problem. The child can identify problems, attempt to find solutions, try out the solution to see if it works, and improve on it.

- **Use TV, computers, and other technologies to support STEM thinking**

View science and technology TV and videos with your child and talk together about the program afterwards.

- **Make your home a STEM-friendly place**

Playing with blocks and Legos is associated with later competence in math and problem-solving skills. Let your home reflect your kids' interests. Be enthusiastic about ideas that your child wants to test and provide a variety of materials and tools that children can access safely.

- **Search out STEM, as a trip to a local science museum**

Visit robotics competitions or maker fairs and encourage your child to ask questions and participate. Look for camps and programs, STEM camps, and science activities.

- **Promote cooperation and teamwork**

Invite kids to work together on a STEM challenge, exploring and experimenting together.

- **Help with STEM activities at school**

Stay in touch with your teacher for information on how and when to do STEM activities at your home.

- **Start exploring careers**

Encourage STEM exploration to help your children visualize themselves in a rewarding career. Involve them in thinking like engineers.

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5. Introduction to Minecraft: Education Edition

The following document is a handbook directed to teachers, educators and IT specialists to guide their trainees in achieving the challenges of the game. This document is strictly for teachers and people you will internally pilot the game. Students do not need access to this information.

This guide gives information on the initial steps to download and run the game as well as to navigate through the created worlds. The document includes also detailed scenarios with the scope of each activity so that teachers can organise the plan of their lesson before introducing this activity. In each activity are also included hacks to let teachers check if their students accurately performed the activities.

5.1 Game specs, account setup and download

Before you start, you need to download the Minecraft Education Edition Package according to the requirements of your device. You can find the edition at the following Link: https://education.minecraft.net/en-us/get-started/download

If your computer runs in Microsoft Windows S mode, you need to deactivate the S mode to be able to download the Minecraft Education Edition.

How to deactivate Microsoft S mode.

Using the Microsoft S mode, the user can only access apps downloaded from the Microsoft App Store. To deactivate the S mode, you need:

- To create a new Microsoft account that is not licensed as a work or school
- Connect this Microsoft account to the laptop
- Then on your PC running Windows 10 in S mode, open Settings > Update & Security > Activation.
- Find the Switch to Windows 10 Home or Switch to Windows 10 Pro section, then select the Go to the Store link.

Note: Don't select the link under Upgrade your edition of Windows. That is a different process that will keep you in S mode.

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- On the page that appears in the Microsoft Store (Switch out of S mode or a similar page), select the Get button. After you confirm this action, you will be able to install apps from outside the Microsoft Store.

https://answers.microsoft.com/en-us/windows/forum/all/s-mode-how-to-turn-off-windows-10/53ce25ce-734b-48b8-8d1e-baa5adb5d88b

To start using the game you need to acquire a Minecraft Education License. There are 2 types of licences to be acquired, academic and commercial. Visit the following link to check the license you are eligible for: https://educommunity.minecraft.net/hc/en-us/articles/360061371532-Purchasing-Options-for-Minecraft-Education-Edition-Licenses

5.2 Run the worlds

Once you download the Minecraft Education Edition, you need to have the worlds named "McWorld" files. Once you double-click these files, they will automatically open the Minecraft Education system. It will request you log in with the account for which you acquired a license from Microsoft for Minecraft Education. The world requires the latest Minecraft Education version to work properly.

Another option will be to import the world manually. When loading the game, after adding your credentials, press play and then you will see on the right bottom part the "Import" button.

Do you face any other problems when loading the world? See if any of these solutions might help.

PROBLEM: The world doesn't have any NPC in it.

SOLUTION: That means that the BEHAVIOR PACK didn't load appropriately with the world.

Exit the world (but not the Minecraft app). Find the world you are looking for and select SETTINGS. On the left side of your screen try to find the TAB that says BEHAVIOR PACKS. Then you will see two TABS on the main screen. ACTIVE PACKS and MY PACKS. Your behaviour pack should be in the tab MY PACKS, which you should click and select activate. If you are not sure what pack you need, go look at the ACTIVE PACKS and one of those should say "This pack is missing". Find the Pack with the same name on the MY PACKS tab and activate it.

PROBLEM: The world has boards that have weird text, say something like the board. Act 1. NPCs have weird dialogue. ETC

SOLUTION: That means that the RESOURCE PACK didn't load appropriately with the world. Exit the world (but not the Minecraft app). Find the world you are looking for and select SETTINGS. On the left side of your screen try to find the TAB that says RESOURCE PACKS. Then you will see two TABS on the main screen. ACTIVE PACKS and MY PACKS. Your behaviour pack should be in the tab MY PACKS, which you should click and select activate. If you are not sure what pack you need, go look at the ACTIVE PACKS and one of those should say "This pack is missing". Find the Pack with the same name on the MY PACKS tab and activate it.

Check if you are facing both of these problems, go to both of these solutions

PROBLEM: The world is in a different language.

SOLUTION: The NANOWARE worlds are translated into different languages. Maybe you have a world that is in a different language than yours. Find the appropriate language and start again. If this doesn't work, set the language of the Minecraft app according to your preference through the SETTINGS. In the English version select the English US option, not the UK.

5.3 Navigation

Once you open the world, you will need to navigate the game. Navigation is possible using your keyboard and mouse. The buttons of the keyboard to be used are:

- W – Move Forward
- A – Move Left
- S – Move backwards
- D – Move right
- SPACE - Jump (Double SPACE to fly when runs in the creative mode)
- E – Open Inventory
- Q – Throw the selected object
- T – Open the chat
- C - Open Code Builder
- **/** - Open chat and automatically add the first character as "/"

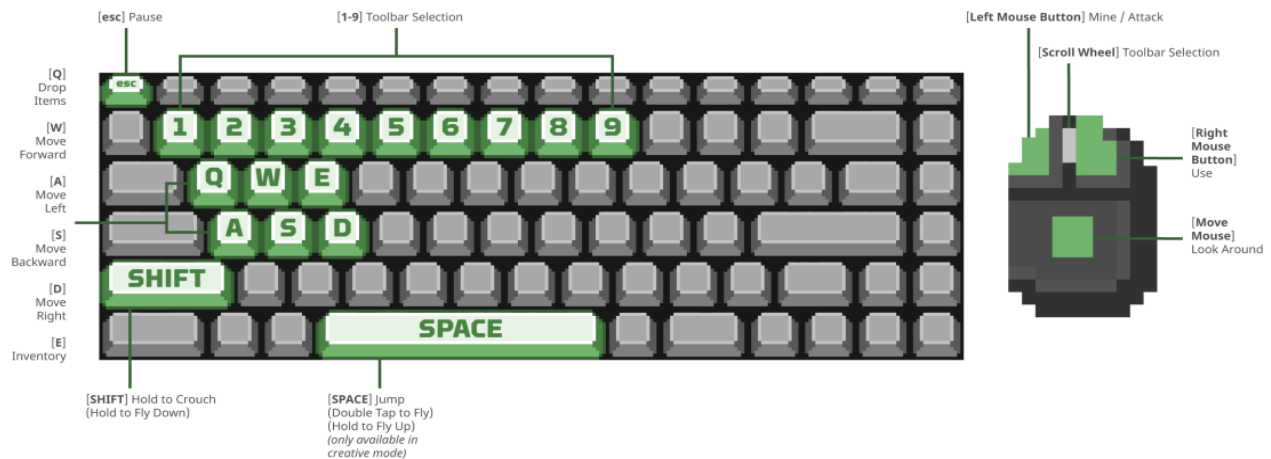You can point the direction also by moving your mouse.

NAVIGATING BASICS

WE DO

Here's all the items you see on your screen and what they mean.

MINECRAFT
EDUCATION EDITION

GAMEPLAY SCREEN FOR MINECRAFT EDUCATION EDITION

W	Forward
S	Back
A	Left
D	Right
SPACE	Jump
SPACEx2	Start Flying
E	Inventory
SHIFT	Sneak

H Hide Controls

Crosshair

Item highlighted is the one in hand

Item in Hand

Hotbar

Place
Mine
Drop

CONTROLS DIAGRAM
KEYBOARD COMMANDS

[esc] Pause

[1-9] Toolbar Selection

[Left Mouse Button] Mine / Attack

[Scroll Wheel] Toolbar Selection

[Q] Drop Items

[W] Move Forward

[A] Move Left

[S] Move Backward

[D] Move Right

[E] Inventory

[Right Mouse Button] Use

[Move Mouse] Look Around

[SHIFT] Hold to Crouch (Hold to Fly Down)

[SPACE] Jump (Double Tap to Fly) (Hold to Fly Up) *(only available in creative mode)*

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6. The NANOWARE Minecraft Worlds

6.1 Nanotechnology in Classroom World

This Minecraft world will engage in a journey through time that will allow the users to live the history of nanomaterials and observe visual examples of how it was used.

Objectives: To teach about the history of nanotechnology and its different applications through time

Starting Point: Inside the classroom

You start in the classroom, where you can chat with the other students and talk with the teacher
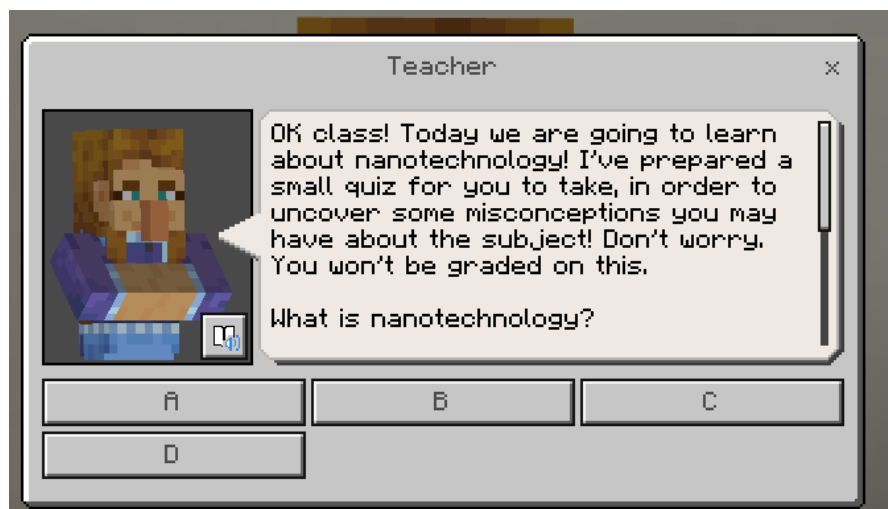
The teacher will test your knowledge of nanotechnology with an entry test with multiple answers. At this point in the game, you will not be able to see whether your answers are correct or not.

When she is done, SIGMA (the above NPC) will appear. After talking again with the teacher, SIGMA and the rest of the classroom will be teleported into ancient times.
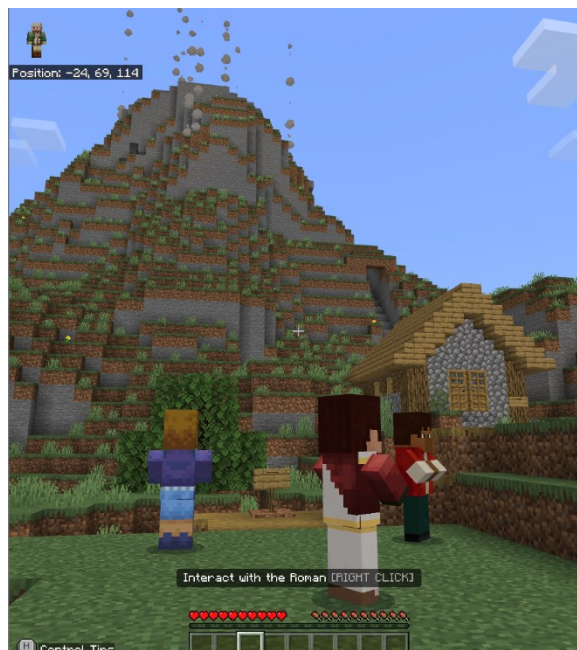
The first destination of your journey is Ancient Rome, in a location inspired by Pompeii, right next to a Volcano. In front of you is a Roman who you should talk to. After a small dialogue, will you be asked to climb to the top of the Volcano? What the player doesn't know is that the volcano is inactive, and it is not spitting volcanic ash (which is a sign it is about to erupt) but other gases such as CO_2, SO_2, and H_2S.
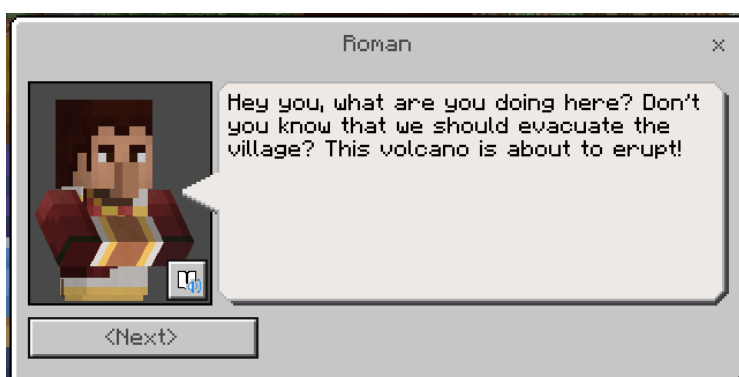
Behind the Roman, there is a sign that indicates the way to the volcano. Following it to the right will lead you to the front of the house. There, you will see another sign that points at the stairs behind the house and leading to the volcano. You should climb those.

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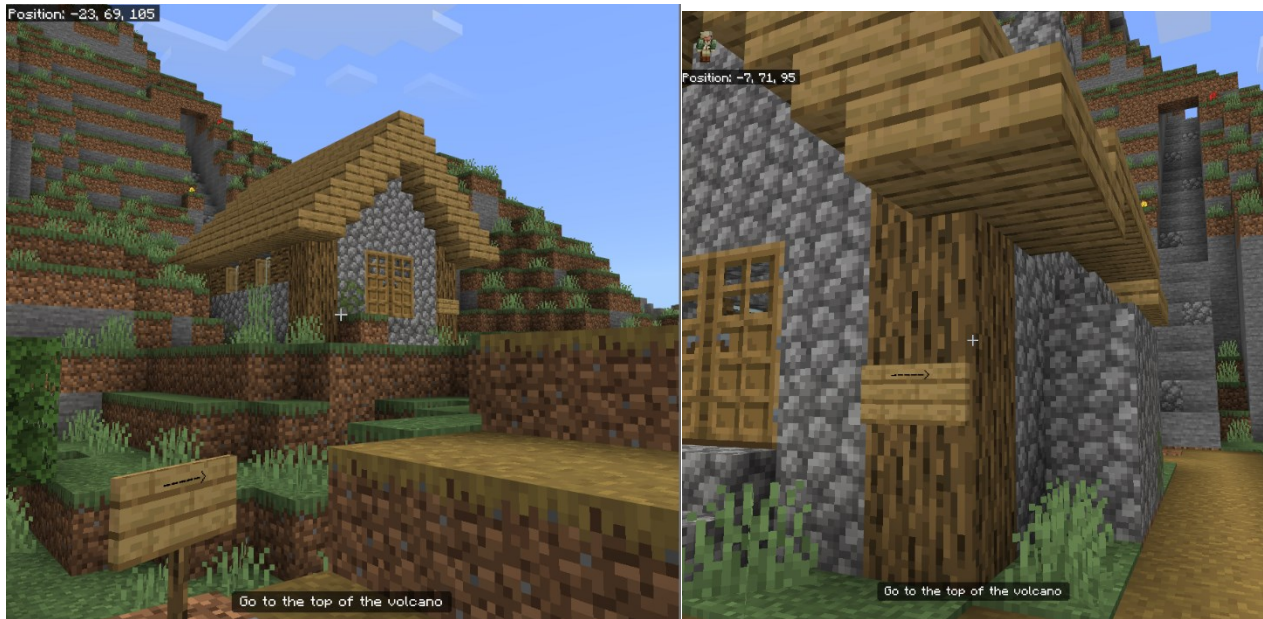
When the first part of the stairs ends, you should go to the left and continue the climb.
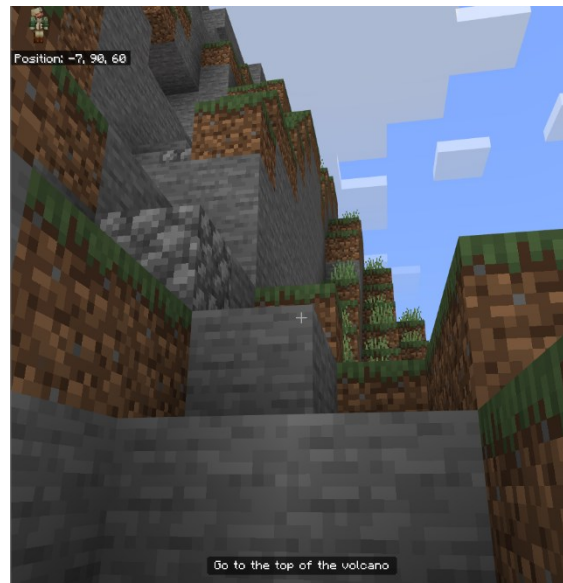
There, you will face a closed entrance to a cave. You cannot enter it now. Instead, go to the left and continue the climb.

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On top, you will see your classmate waiting for you right next to the volcano's mouth. You should talk to her as she will give you interesting information about volcanic ashes.

Student Mia

You see, an active volcano spits out volcanic ash and smoke which is made of nanoparticles of rocks, glass and various minerals. This smoke on the other hand is made of Carbon Dioxide which is the same thing cars exhaust, and it means that something organic fell into the volcano and is burning... Oh look, a landslide caused this tree to fall in!

That's nice!

After the dialogue, she will disappear, and the entrance to the cave that was once closed will be finally opened.

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Walking inside the cave, you will face a lava pit. By jumping with the space bar, you should jump on the floating blocks of rocks and head to the left, where the Roman can be seen. Don't worry, if you end up in the lava, you will simply be respawned at the entrance of the cave.

After the jump, you will face the whole classroom and the roman. Behind him is the Lycurgus Cup. Talking with the Roman will give you more information about it...

You will be asked to interact with the cup. By doing it, the cup will change colours as an effect of nanomaterials.

After doing so, you will talk with the teacher and be transported to another era.
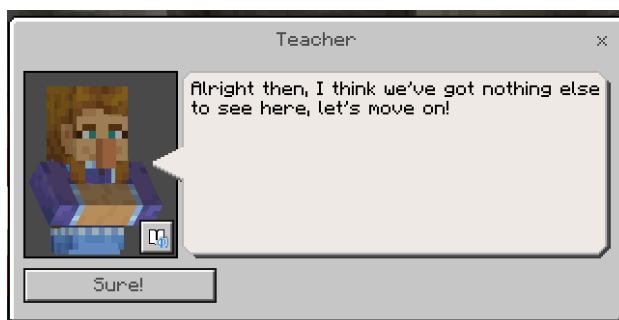
This time you will find yourself in the Middle East in the 13th century. You will talk to the teacher.

You will follow the grey trail behind the teacher, which will lead to a house with a blacksmith inside.

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You will talk to the blacksmith, who will tell you information about Damascus steel and its use.
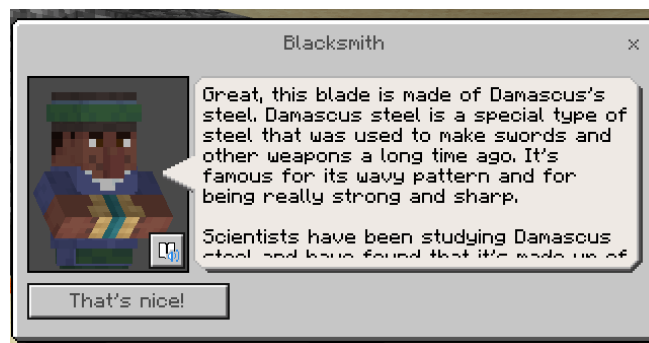
You will then receive a pickaxe from the blacksmith and ask to mine 3 ores of iron. Outside the house, next to the location where your class is, you will find white dots indicating where the iron is located.

After collecting the ores, go back to the blacksmith's house and speak to him. You will receive a blade of Damascus Steel.

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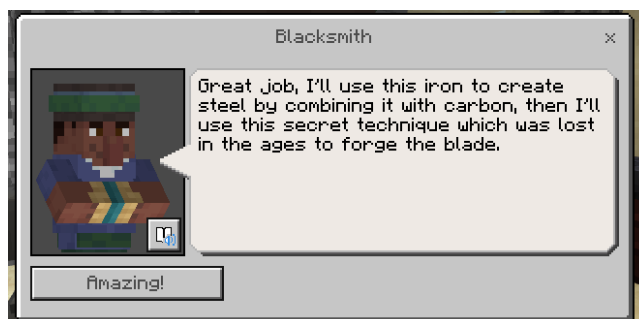
Go out of the house and on your left you will the teacher standing next to a tree. You are asked to go there and cut down the tree with your new blade.

Clicking on the odd part of the tree with the blade will result in the tree falling instantly. After doing so, you should talk to the teacher.
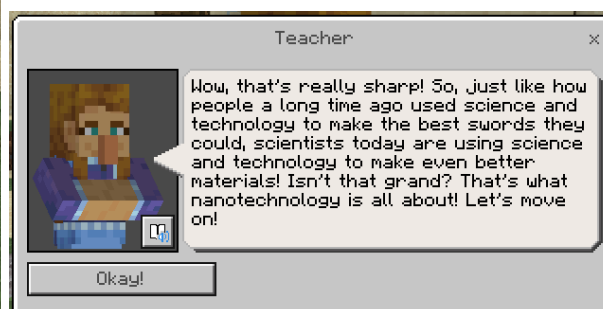
After talking with the teacher, you will be teleported to the final era of this world. Specifically, you will be placed in Faraday's laboratory. Here you will interact with him.

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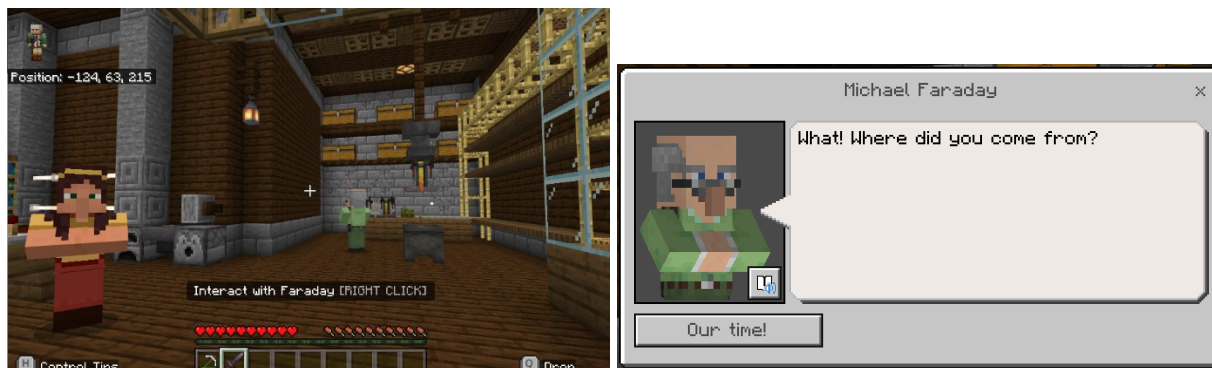
Talking with Faraday will result in him giving you HAuCl4, which will need to be dissolved in the water right next to the scientist.

Doing so will result in the water turning yellow and in Faraday handing you another solution to dissolve into the water. After doing so, talk to the teacher. and the students.

After the dialogues, you will be teleported to a museum where different paintings are displayed.

Talk with all the NPCs. After that, you will be asked by the Museum curator to interact with 3 buttons next to the main painting of the museum. You can interact with them with the right click of your mouse.

Clicking on the different buttons will show how time deteriorates the painting. After observing the differences in times, you should talk with the museum curator once again.

The curator will educate you about cosmic rays and their impacts on paintings. Then, it will tell you about how the solution you prepared before can prevent this deterioration from happening. After the dialogue, you should click on the 3 buttons once again.

Unlike the first time, this time all the buttons will reveal the same painting, as proof of the benefits and utility of nanomaterials. After checking again, you should talk to the museum curator. You will be then teleported back to the initial classroom.

Here, you will talk to the teacher and redo the initial test that was presented to you at the beginning. This time will be able to see if your answer is correct or wrong.

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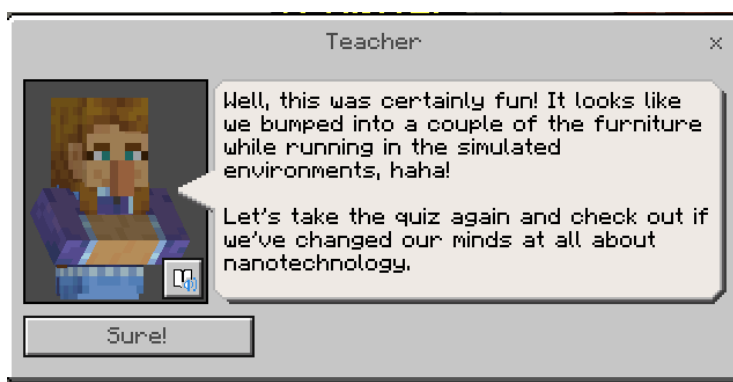
Solutions: (To be used only by teachers – Correct answer in bold)

- What is nanotechnology?

  a. The study of large-scale materials and structures

  b. The study of materials and structures on a very small scale

  c. The study of plants and animals

  d. The study of computer programming

- What is the Lycurgus cup?

  a. A cup made of nanoscale gold and silver particles that change colour depending on the angle of light

  b. A cup made of Damascus steel

  c. A cup used for ancient Greek sports events

  d. A cup made of clay and used in ancient Egypt

- What is Damascus Steel?

  a. A steel used in modern construction

  b. Steel used in ancient Egyptian jewellery

  c. A steel used in medieval swords and knives

  d. Steel used in modern electronics

- What is an example of a nanomaterial used in our everyday lives?

  a. Nanoparticles in sunscreen

  b. Nanoparticles in paint

  c. Nanoparticles in cosmetics

  d. All of the above

- How can nanomaterials improve the performance of everyday objects?

  a. They can make objects lighter and stronger

  b. They can make objects more resistant to heat and corrosion

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c. They can make objects more flexible and durable

d. All of the above

- What is a volcanic ash particle?

   a. A small particle released from a volcano that can cause respiratory problems

   b. A small particle that is used in electronics

   c. A small particle that is used in sunscreen

   d. A small particle that is used in paint

- How are nanomaterials used in medicine?

   a. To create more effective drug delivery systems

   b. To create artificial organs

   c. To create stronger bones and tissues

   d. All of the above

- What is an example of a nanomaterial used in food?

   a. Nanoparticles in food packaging to keep food fresh longer

   b. Nanoparticles in food to enhance flavour

   c. Nanoparticles in food to make it more nutritious

   d. None of the above

- What is an example of a nanomaterial used in electronics?

   a. Nanoparticles in computer processors

   b. Nanoparticles in cellphone screens

   c. Nanoparticles in batteries

   d. All of the above

- How can nanomaterials be harmful to the environment and human health?

   a. They can accumulate in the environment and disrupt ecosystems

   b. They can be toxic to organisms and cause health problems

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c. They can lead to the development of antibiotic-resistant bacteria

d. All of the above

After solving the quiz, you will be rewarded with diamonds and the lesson will be over.

6.2 NanoLab World

This Minecraft world will represent a Nanotechnology Laboratory. The user will view the different Microscopes used in Nanotechnology.

Objectives: To learn about the methods of analysis of nanomaterials and of the different properties of the latter

Starting Point: At the entrance of the laboratory

You are in the Laboratory and as a first task, you need to talk to the scientist in front of you. Walk towards the scientist and press right-click on the NPC to talk to.
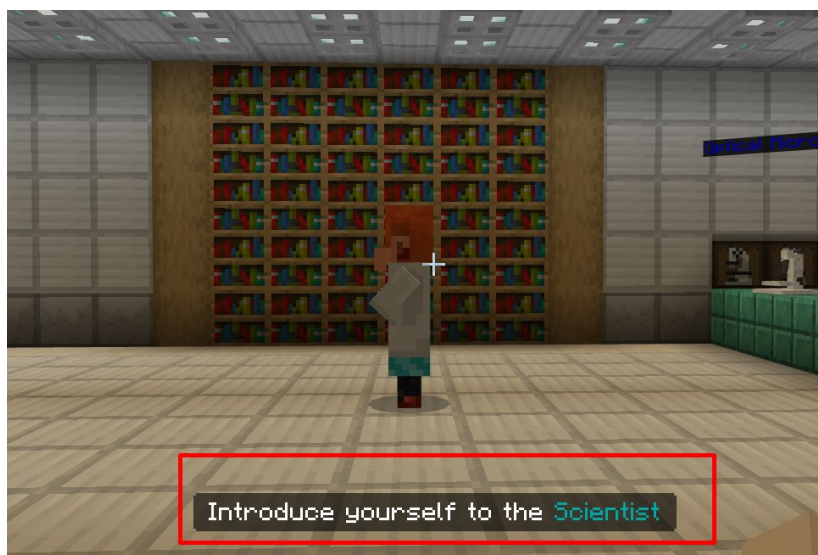
The dialogue starts.
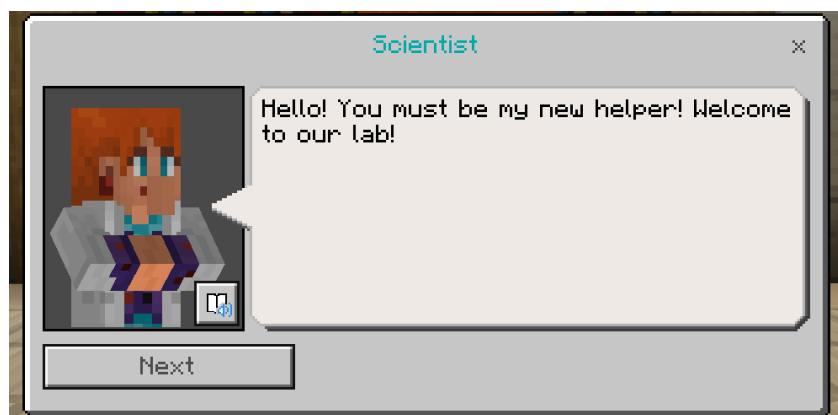
Follow the scientist and listen to her. She will give you more information on the microscopes. Press right-click on her to talk and read the given information.

Once she finished with all the explanations you will find her in the next room.

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Once you are in the lab, you can learn more about the microscopes by clicking on them and pressing the right click.
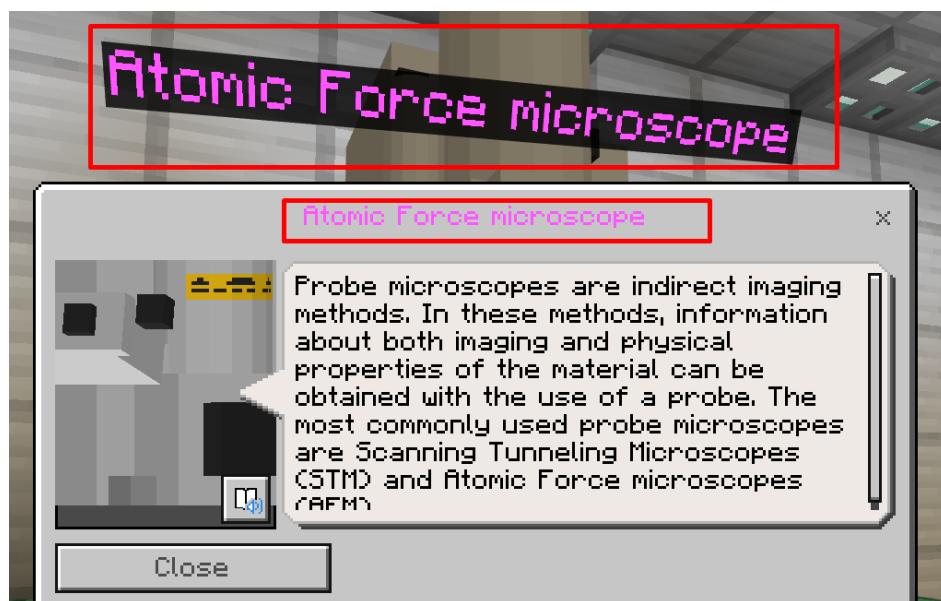
Find the Storage Room

To reach the storage room you need to pass through this door.

Find the Scientist and talk to the NPC.

The scientist will give you a small piece of gold to examine.

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Golden Piece Examination in Optical Microscope

Go back to the lab and use the Optical Microscope to view the material the scientist gave you. Press Right Click on the Microscope and press examine.

You will be teleported inside the microscope to view the analysis of the golden piece.

On the left you are examining the material and on the right you will have to talk with the Scientist once you finish observing it. A questions and answers session will begin once you click with the right on the scientist. Once you reply correctly to all the questions you will be brought back to the lab.
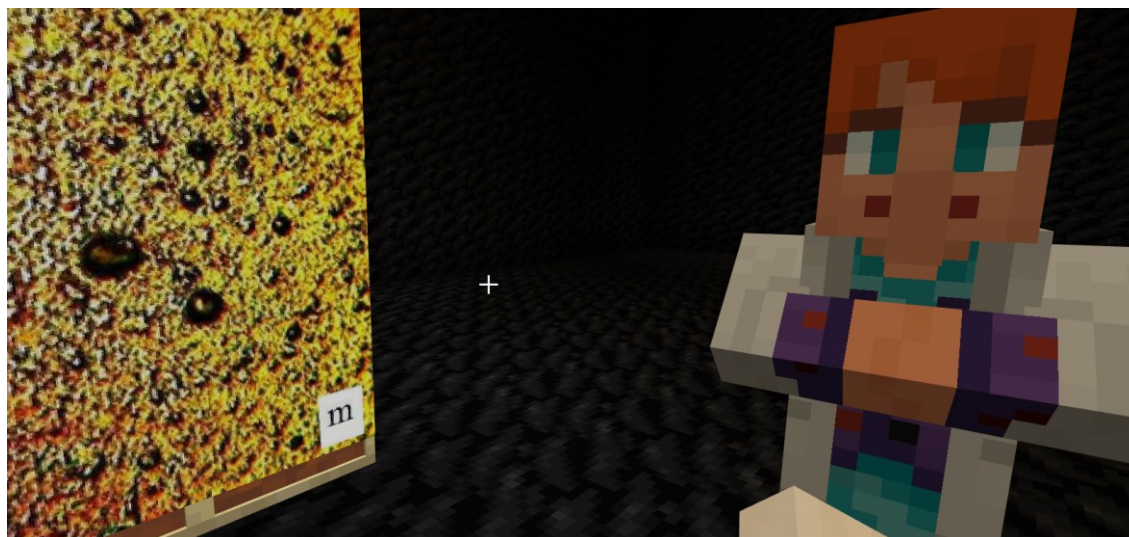
Solutions: (To be used only by teachers)

How would you characterise its colour? Answer: Yellow

How would you characterize its surface? Answer: Rough

Does it seem to present any periodic pattern? Answer: Not really

Gold Piece Examination in Electron Microscope

Now you have to go to the Electron Microscope and examine again the golden piece.

On the left you are examining the material and on the right you will have to talk with the Scientist once you finish observing it. A questions and answers session will begin once you click with the right on the scientist. Once you reply correctly to all the questions you will be brought back to the lab.
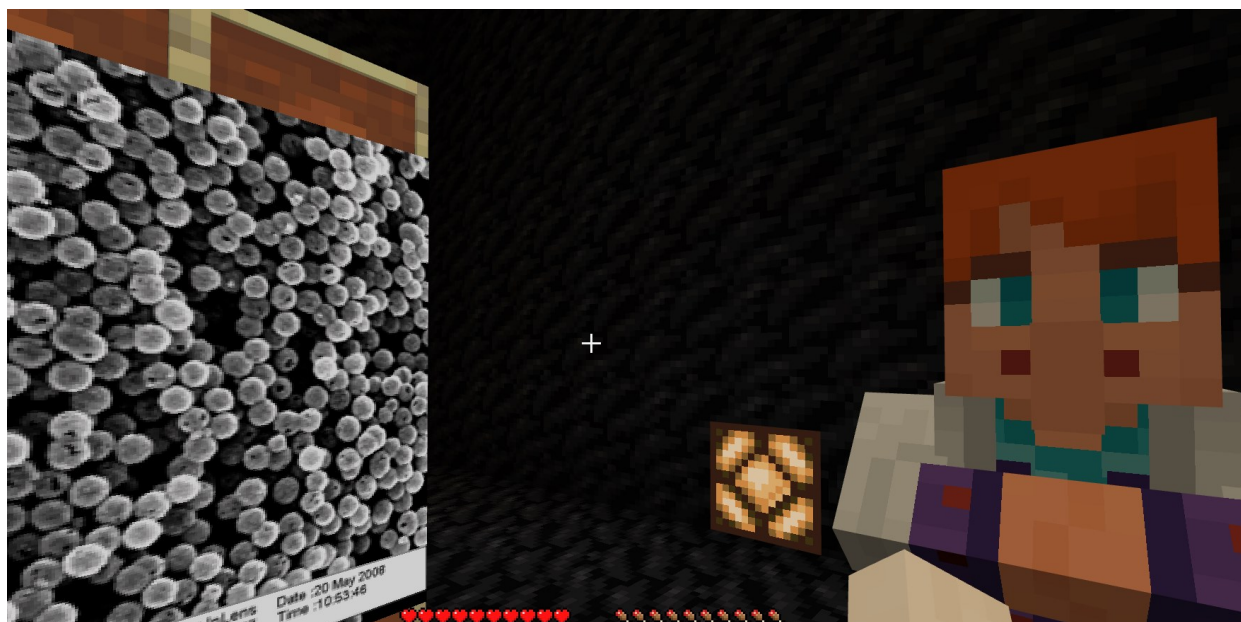
Solutions: (To be used only by teachers)

Do they appear to have the same size each time? Answer: Pretty much

Do you see a certain pattern forming? Answer: Not really

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Probe Microscopes Examination

Now you have to examine the probe microscopes

These are located as you see in the following picture. Press right-click on the Microcopes and click the examine button. You will get more information. Once you are ready click the Scientist to go back to the lab.

Once you examine these 2 Microscopes the lesson is complete

6.3 NANO-X World

This Minecraft World will represent a Nanotechnology Exhibition. The user will have to follow a structured path indicated with coloured lines in the game. In each space, different topics are represented with activities to be performed including information on the nanoelements used. The topics will be:

- • Nanotechnology and Engineering
- • Nanotechnology and Medicine
- • Nanotechnology and Products (Everyday use)

Starting Point:

Talk to the Guide by pressing the right-click on your mouse.

After a small dialogue, the guide will welcome you to the Engineer section of the world.

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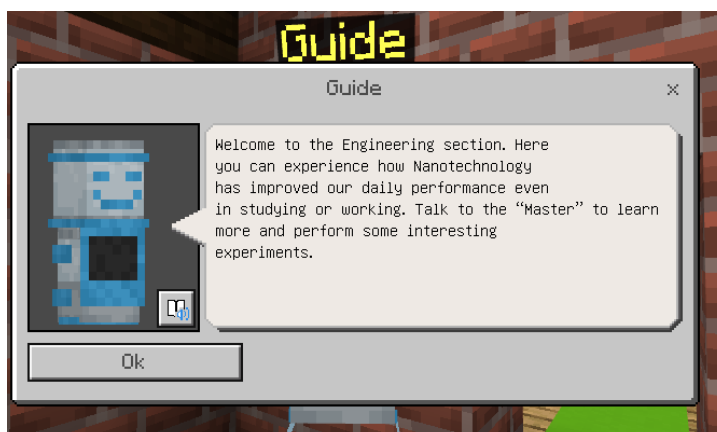
In the first room, you will meet the NPC which will ask you about your knowledge of nanotechnology.
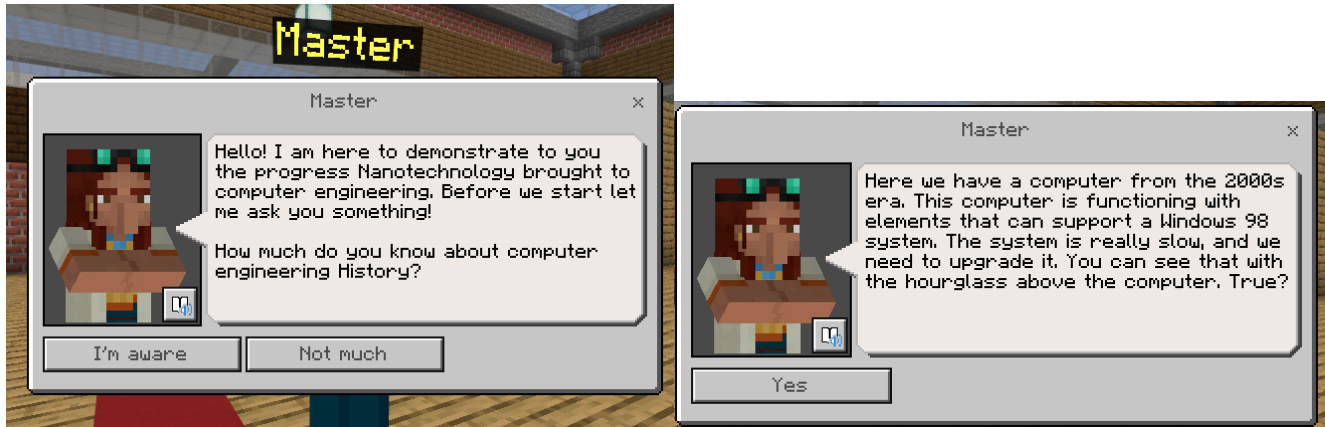
You will then observe on the right a computer with an hourglass on, showing its slowness. Talking again with the master will result in the start of a fetching quest. You will have to find the nanotech components required to make the computer run faster.

The one in the image below is one of the components to be found in the chests. They all share the same look but have different names.
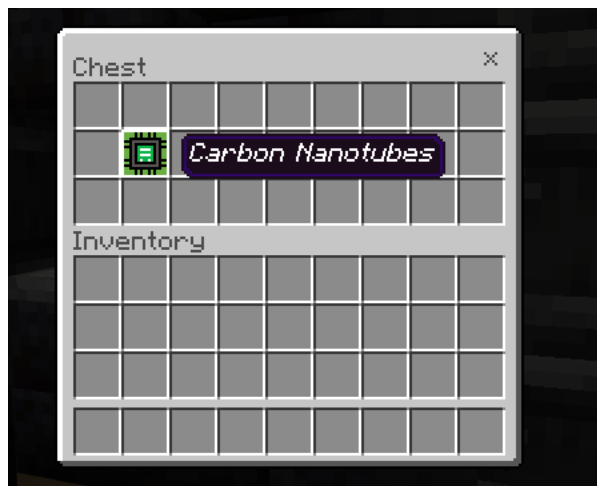
Some chests will present items that are not required to fix the computer. You can ignore those. From the outside, the chests look all the same regardless of their content. In Green, you can find the first component, *Carbon Nanotubes,* while in the chest in Red, you will not find anything useful to proceed with the game.

Solutions: (To be used only by teachers)

Below a is list of where to find the components.

1. Carbon Nanotubes
2. Actuator
3. Computer chip
4. Silicon nanowires
5. Supercapacitor

1. Carbon Nanotubes

These are found at the bottom-right of the room.

Chest for carbon nanotubes
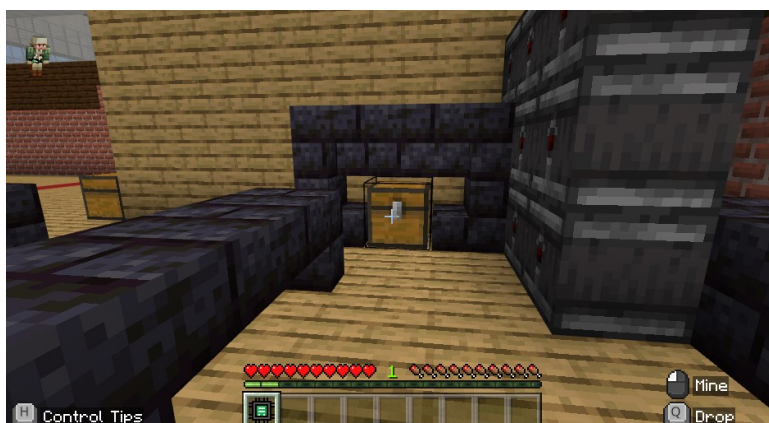
2. Actuator

To be found in the center-left of the room, close to the computer under a dark structure.

3. Computer chip

The chest for the Computer chip is hidden behind this wall, next to where the chest for the Actuator is to be found.

Entering the room will lead you to its chest.

4. Silicon Nanowires

Behind the two pot plants at the left corner of the room, there is a hidden chest that contains Silicon nanowires.

5. Supercapacitor

Similar to the Silicon Nanowires, this chest can be found behind the two pot plants at the top of the room.

All five elements can be inserted into the computer at any given moment. There is no need to collect all the elements to insert one into the computer. However, all elements will have to be found and inserted into the computer to proceed with the next part of the game.

Every time an item is inserted into the computer some text will appear on the top left of the screen, describing the proprieties of the inserted item.

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By pressing [T] all the info about each component will be readable on the screen.
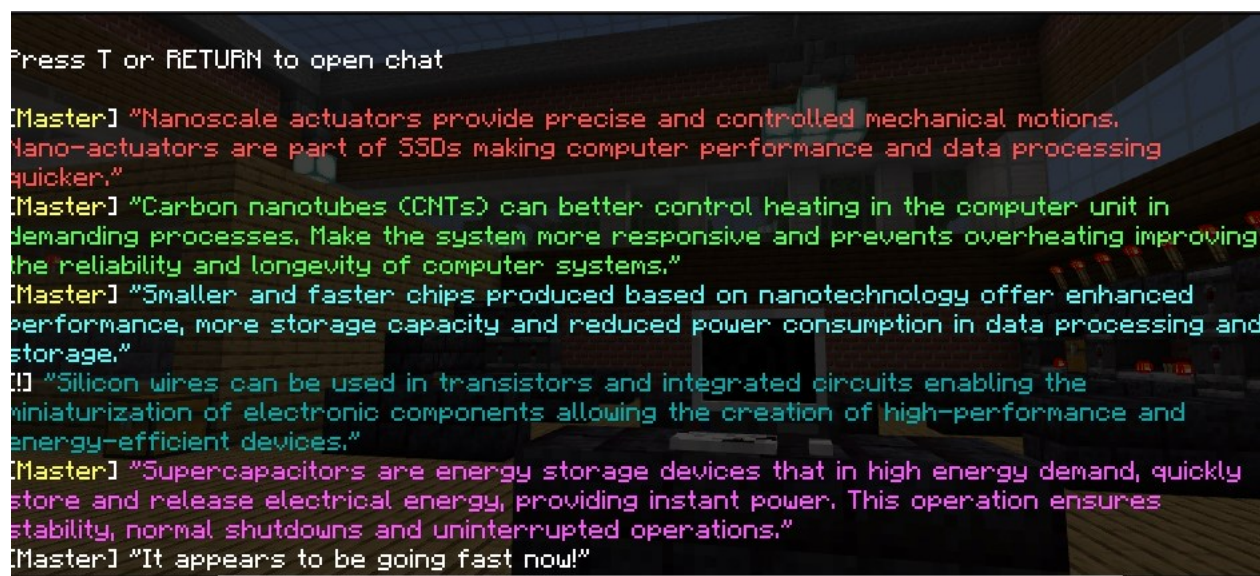
After fixing the computer, the hourglass will disappear and the master will congratulate you. The door for the next activity will open.

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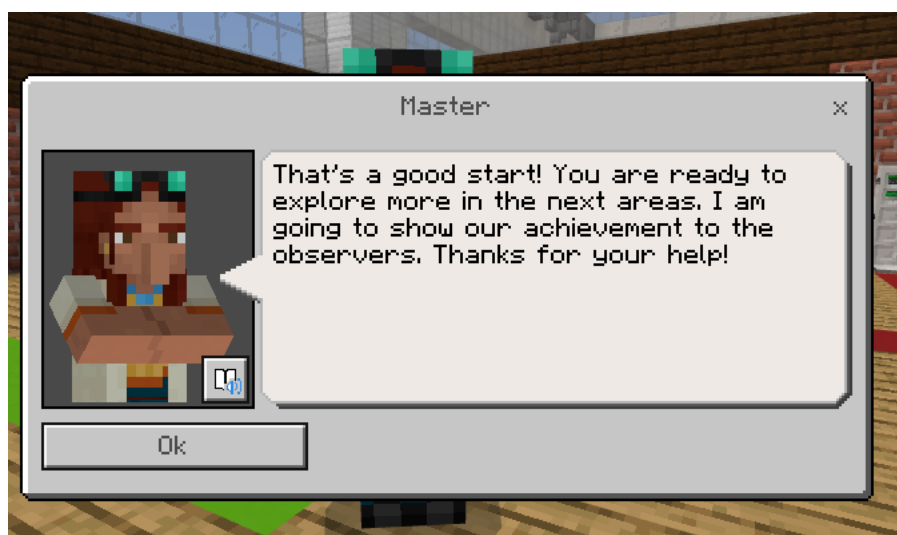
Following the red line, you will be faced once again by the guide, who will welcome you to the Medicine section of the game.
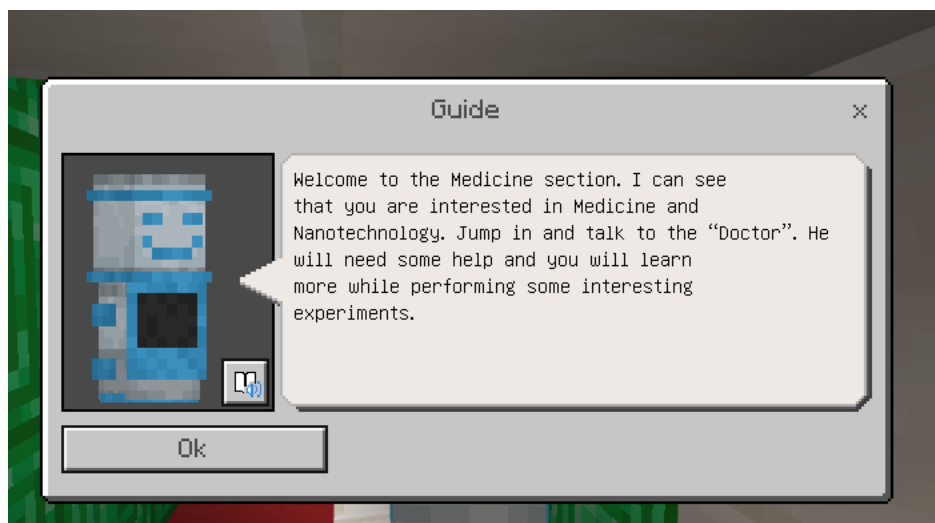
In the new area, you will talk to a doctor.

The doctor will ask you about your knowledge of nanomaterials in medicine and will then request you to collect all the lab pieces inside the chest behind him and build a functional laboratory.

In the chest, you will find the lab components each with their name displayed when clicked on with the cursor. You will position with the right click of the mouse each component to the respective part. In case of a mistake, you can mine the wrongly positioned component with a diamond pickaxe and fix the error.
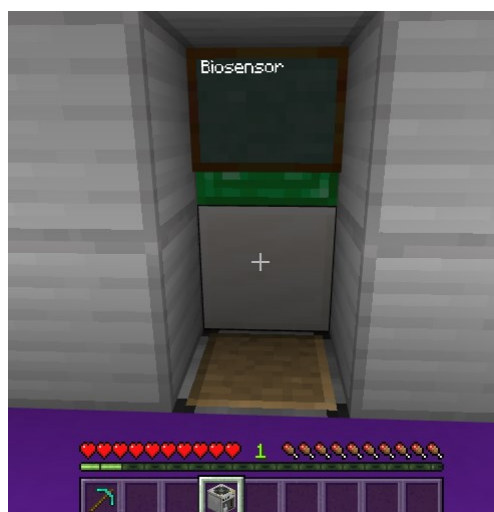
Having fixed the lab, the doctor will ask to talk with him once again. Doing so, he will first thank you for your work and then he will ask you to experiment.
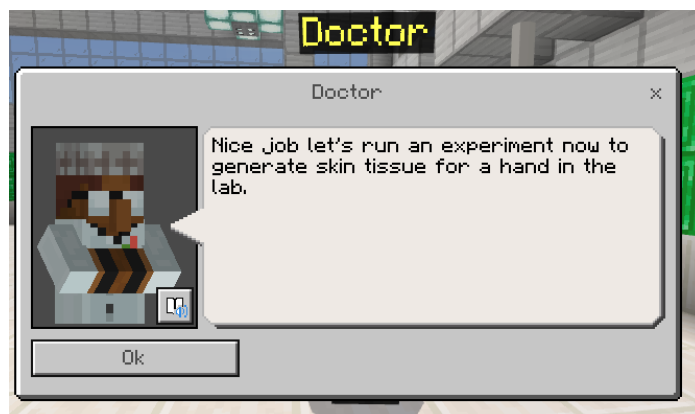

You will be given some Stem Cells to be put in the bioreactor behind the doctor. Click on it with the right-click on the mouse and wait for the Doctor's response info about cells.

You will receive then more elements from the doctor, namely: Cell Culture Media, Scaffolds, Growth Factors and Elasticity Nanomaterials. Repeat the actions done for the Stem Cells until you get all the information regarding each item.

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After doing so the Doctor will tell you to check the growth process. Moving to the left, you will see a structure with a wooden bottom that you will have to press.
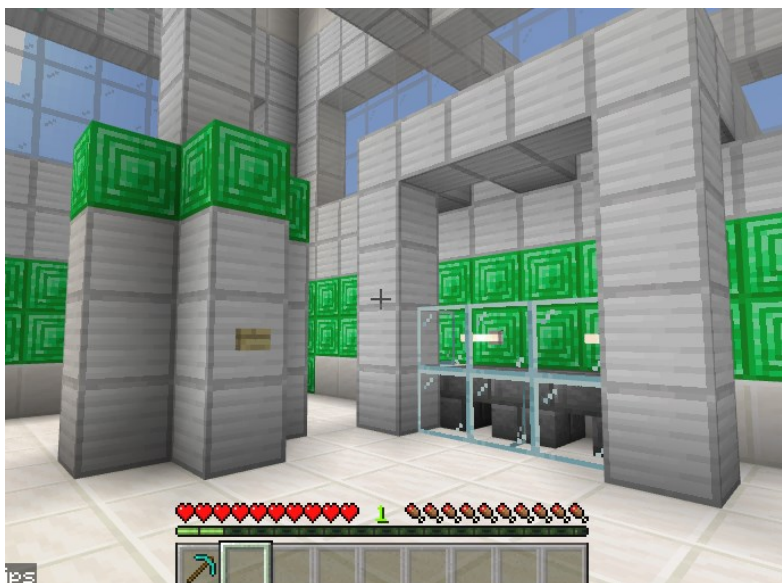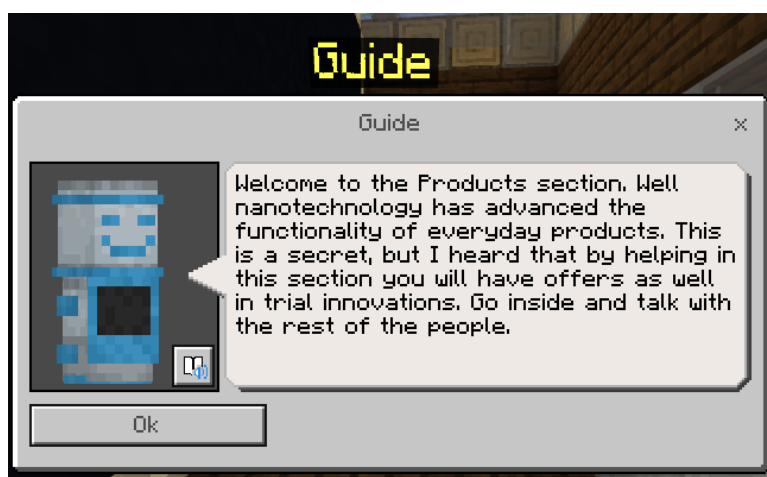

Clicking on the bottom will let the machine grow a synthetic hand using the stem cells and the other elements used before in the bioreactor.

After this last task, the doctor will congratulate you and send you over to the next and final room of the game.
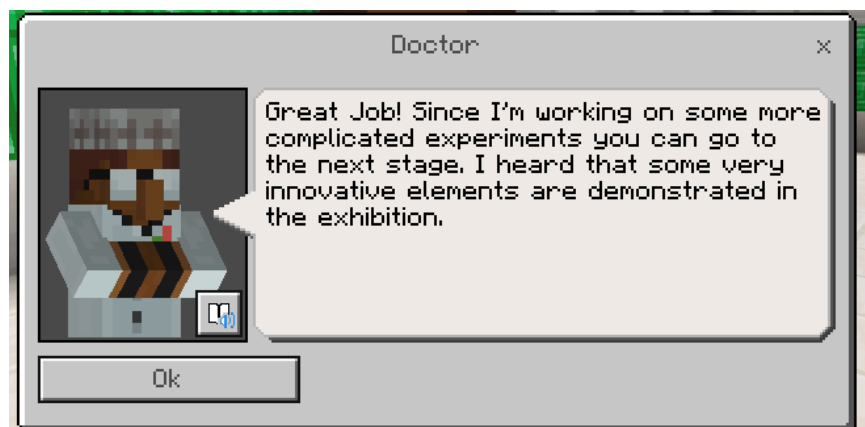
Here again, you will find the guide to the exhibition welcoming you to the Products sections. Talk to him to proceed.


At the exhibition, you will a vendor find who will ask you some simple questions about nanomaterials. Regardless of your answer, he will explain to you how nanoparticles are used in certain products.

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You will then be asked to click on the bottom right next to the two t-shirts to pour water on them and see the effects of nanomaterials on cloth.
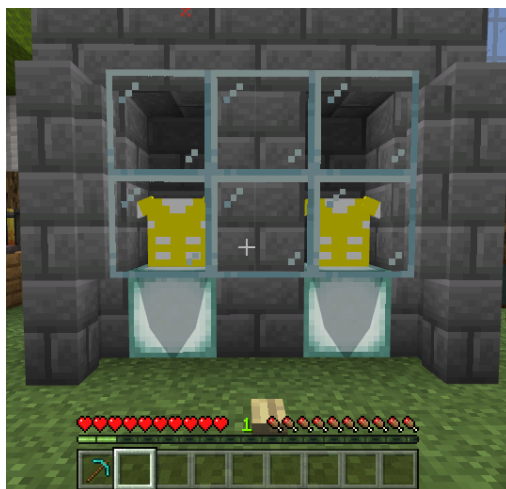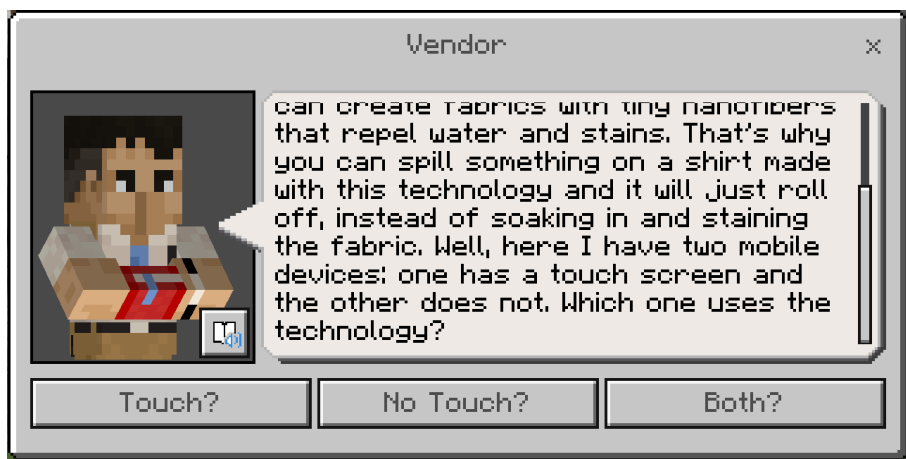

By clicking on the said bottom with the right click, you will see water coming out from the structure onto the t-shirts. After doing so, you will notice that the T-shirt is wet while the left one is waterproof. Speaking to the vendor, you will tell him which t-shirt has been made with nanoparticles.
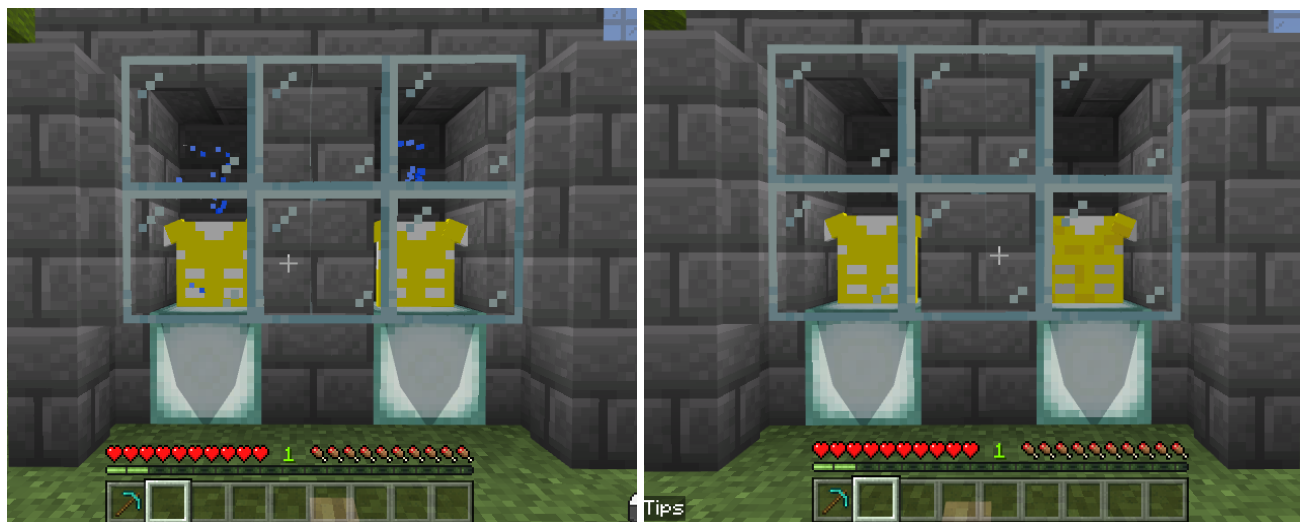

The vendor will teach you about how nanoparticles have been used in turning the t-shirt waterproof.

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Finally, he will ask the last questions about mobile phones and the usage of nanomaterials.

Regardless of the answer, the vendor will explain to you how nanomaterials are used in touch screen devices.
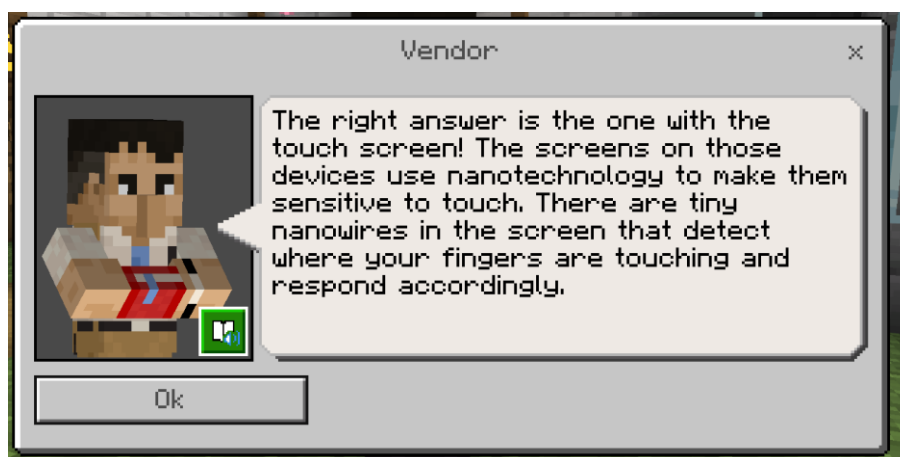
Ending the conversation with the vendor will result in the completion of the game. Congratulations!

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