







Attracting students' interest in mathematics and improving their skills, comprehension and performance with the use of a virtual reality educational platform

TRAINERS HANDBOOK

ERASMUS + 2020-1-RO01-KA201-080410 Strategic Partnerships for school education Cooperation for innovation and the exchange of good practices





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1. INTRODUCTION

The MATHESIS 3D World is the main output of the MATHESIS project, hosting all learning material developed along with learning scenarios. The platform is freely available for students to use for self-learning purposes.





2. CONNECTION INSTRUCTIONS

2.1 Account Creation

You can create an avatar account (Firstname, Lastname, Password) in one of the following sites:

http://80.86.110.155:9000/wifi/user/account/

http://aigroup.ceid.upatras.gr:9000/wifi/user/account/

http://virtualworld.sch.gr:9035/wifi/user/account/

The Email field is optional. You will need to remember your First Name, Last Name and Password to be able to connect, so make sure you write them down.





Create new account	
First Name: (*)	
Last Name: (*)	
Email:	
Password: (*)	
Retype password: (*)	
Type of avatar:	
Female Mala	
Neutral	
create	





2.2 Installation and Initial Configuration

To connect to the 3D World with that avatar you need 3D viewer Software such as Firestorm or Kokua. We recommend using Firestorm. You can download the version for OpenSim here: <u>https://www.firestormviewer.org/os-operating-system/</u>

Scroll down to the "**Choose your Operating System**" section, select your Operating System from the available icons and download the suitable version.



Once you have downloaded, installed, and opened Firestorm, you need to add the MATHESIS 3D World in the list of available destinations (you only do this before connecting for the first time):

1. Viewer -> Preferences -> OpenSim





 Add new grid: Depending on the site where you created your account use one of the following values: <u>http://80.86.110.155:9000</u>
 <u>http://aigroup.ceid.upatras.gr:9000/</u>

http://virtualworld.sch.gr:9035

3. then click 'Apply' and 'OK'

The grid should be now added to the Manage Grids Table.

Viewer Help		
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virtu	MATHESIS	
HESIS	Dreferences	
Preferences		? _ ×
Search Settings		
General	Grid Manager Miscellaneous	
Chat	Add new grid	
Colors	http://aigroup.ceid.up/	atras.gr:9000/ Clear Apply
Graphics	Manage Grids	
Sound & Media	Grid name	▲ Login URI
Network & Files	Littlefield Grid	lfgrid.com:8002
Move & View	MATHESIS	aigroup.ceid.upatras.gr:9000
Controls	Metropolis Metaversur Mobius Grid	m hypergrid.org:8002 Remove
Notifications	OpenSim Community (C cc.opensimulator.org:8002
Privacy	OSGrid	login.osgrid.org 🗸
Advanced	Grid Namo	
User Interface	Grid URI:	MALHESIS http://ajoroup.ceid.upatras.or:9000/
Skins	Login Page:	http://aigroup.ceid.upatras.gr:9000/wifi/welcome.html
Crash Reports	Helper URI:	
Firestorm	Grid Website:	
Opensim	Grid Registration:	http://ajgroup.ceid.upatras.gr/9000/wifi/user/accoupt
Backup & Restore	Grid Password URI:	http://aigroup.ceid.upatras.gr:9000/wifi/forgotpassword
	Grid Search:	
	Grid Message URI:	
	name	UK Cancel





2.3 Connecting to the 3D World

Use your username "Firstname Lastname" and password and select the "MATHESIS" grid from the drop-down menu. Click 'Log In' to enter.



If the "Grid" dropdown list does not appear in the form, then you have probably downloaded the wrong Firestorm option (return to the installation instructions and make sure you have selected the Opensim version of Firestorm).

After a connection is made you will be inside the virtual world with your avatar.







The first area covers the basic controls for moving around with your avatar and controlling the camera. At the end of the room, follow the instructions to fly over the wall to the next room, where you learn how to customize your avatar's appearance.



You also learn how to sit on specific items (chairs etc) and how to stand up.











Finally, you learn how to communicate with other avatars.



Stepping out of the tutorial building you are in the open area where all the learning activities take place. There is a map panel nearby that you can use to find a specific learning topic.





3. BASIC CONTROLS

3.1 Moving Around

As mentioned in the previous section, a presentation near the landing point, covers all the basic controls for moving around and controlling the camera. Follow the instructions and try to get accustomed with controlling your character.

If you like, you can choose to customize your character following the instructions.

3.2 Navigation

There are two kind of maps you can use for navigation:

World > Minimap

- It shows a small map where you can Identify your location and it updates according to Avatar movement
- It acts as a compass
- You can use this map to **teleport** to another point by Double Clicking required location

World > World Map

- Larger overview of the region with filtering feature
- You can zoom in/out to find more regions nearby

3.3 Inventory

Each avatar has an inventory of files organized by file type:

Avatar > Inventory (Ctrl + I)





Inventory	? _ ×
Filter Inventory	
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You can create files for your avatar's appearance (BodyParts and Clothing folders), you can find or create text files with notes (Notecards folder) or find Objects that you have received from the activities (Objects folder).





3.4 Communication

You can add other user avatars as friends to easily find them and be able to teleport to them. From the viewer's navigation bar, select **Comm -> People**, to open a window that display a list with all nearby users. Right click on one of the users and you get the option to view their Profile, add them as a friend, send a private instant message (IM), request that you teleport to them (**Request Teleport**) or that they teleport to you (**Offer Teleport**), and to create a distinct marker on his place to easily find him (Track).

Favorites Bar	People					? _ ×
	Nearby Friends	Groups	Recent	Blocked	Contact Sets	
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	Brad Wayne		S	15	0:29:16 90.54	
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and the second se	Daniel Lorenzo			15	0:29:16 100.45	
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	Garry Riordan			13	0:29:16 35.89	
1	Harry Bieder			29	0:29:16 126.74	
	Harry Block	мар		10	0:29:17 106.37	
	Hope Andrews	Track		10	0:29:17 95.39	
1 5	Jenny Noris	Mark	►	10	0:29:16 131.77	
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If you have already added some user as a friend, you can find them in the 'Friends' tab, even if they are not online at the moment. You can send them a private message and they will be able to see it as soon as they log in the virtual world.





You can open the chat window (**Comm -> Chat**) to view and participate in conversations. The default '**Nearby Chat**' displays all discussions that happen near your avatar. There is also a shortcut for righting quick messages that nearby avatars will receive by using the chat bar on the bottom left of your screen.

You can configure **Gestures** to be used with chat. Gestures are animations performed by your avatar to indicate or emphasize your attitude or your emotions. You can associate specific Gestures with specific words, so when you include them in your chat messages, your Avatar will perform the animations.

First, open your Inventory (**Avatar -> Inventory**) and locate the "**Gestures Library**" folder, under "**Opensim Library**". There are several gesture files in that folder, and you can right click and select "Activate" the ones you want your avatar to be able to perform.

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Filter Inventory			1 - 2	Beestine 2002 10 0314 00 57	- ^
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dancel (active)	raise hand	/cringe		Start Annation, Deny Edugit	
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😲 dance3 (active)	take it outside	/snar			
🤴 definitely YES (active)	Wave	/wave			
😈 LOL (active)	whoohoo!	/woot!			
🖗 me! (active)	Wink!	/wink		(options)	
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Then open the Gestures Window (**Comm -> Gestures**) and you will see the Gestures you have activated. Double click on one of the Gestures and you will see your avatar performing the animation. Select a Gesture and click the "**Edit**" button to view the details. There is a **Trigger** field that shows the command to use in chat to perform the Gesture. For example, you can write **/LOL** in the chat menu to make your avatar perform a laughing animation.

You can use the groups window (**Comm -> Groups**) to join or create a Group with other users to communicate with. Communication with voice with other users in the virtual world is not possible directly from the 3D Viewer.





However, we have prepared a voice channel in a Discord server (<u>https://discord.com/channels/530417588509868032/1039924909159231540</u>), where users can join and participate in conversations while they are connected to the 3D World. You can direct all your students to enter the "mathesis-voice" voice channel.





4. THE MATHESIS TOPICS

The following table lists all the learning topics covered by the MATHESIS platform:

No.	Activity ID	Subject	Activity Name	Proposal topic
1	NC1-K7	Numbers & Calculations	Whole Numbers	Arithmetical methods of problem solving
2	NC2-K7	Numbers & Calculations	Ordering of Fractions	Ordinary and decimal fractions
3	NC1- K7/K8	Numbers & Calculations	Calculation with Fractions (addition, subtraction, multiplication, division)	Ordinary and decimal fractions
4	NC2- K7/K8	Numbers & Calculations	Comparing Fractions	Ordinary and decimal fractions
5	NC3- K7/K8	Fractions	Conversion of Fractions & Decimal Fractions as Common Fractions	Ordinary and decimal fractions
6	NC1-K8	Numbers & Calculations	Ratio & Proportion	Reports. Proportion
7	F1-K7/K9	Functions	Linear / Quadrilateral	Functions and equations
8	F2- K11/K12	Functions	Derivatives	Derivatives. Derivatives calculation
9	F3- K11/K12	Functions	Definite Integrals	The definite integral
10	G1-K8/K9	Geometry	Relationships Between Angles	2D & 3D Geometry (including Quadrilateral)
11	G2-K8/K9	Geometry	The Circle & Related Concepts	2D & 3D Geometry (including Quadrilateral)





12	G3-K8/K9	Geometry	Regular Polygons I	2D & 3D Geometry (including Quadrilateral)
13	G4-K8/K9	Geometry	Regular Polygons II	2D & 3D Geometry (including Quadrilateral)
14	G5-K8/K9	Geometry	Geometric Constructions	2D & 3D Geometry (including Quadrilateral)
15	G1-K10	Geometry	Calculating Angles Related to Polygons	2D & 3D Geometry (including Quadrilateral)
16	G2-K10	Analytical Geometry & Vectors	Angle Between Vectors in the Plane	2D & 3D Geometry (including Quadrilateral)
17	TSM1- K7/K9	Thinking Skills & Methods I	Logical Thinking: Measurement / Comparison / Conversion	Units of measure
18	TSM2- K7/K9	Thinking Skills & Methods II	Logical Thinking: Measurement / Comparison / Conversion	Units of measure
19	ANT1- K11	Algorithm & Number Theory	Basic Concepts in Algorithmic Thinking: Sequencing, Selection & Repetition	Arithmetical methods of problem solving
20	ANT2- K11/K12	Algorithm & Number Theory	Gaussian Elimination	Matrix computation elements and linear equations systems
21	3DG1- K12	3D Geometry	Vector Format in a 3D Coordinate System	Trigonometrical Elements





As mentioned previously there is map panel after the tutorial area, where you can select a specific learning topic to directly teleport to it.



All the learning activities are accompanied by a presentation panel with the corresponding theory. It is advised that the students first study the theory before trying a learning activity. The Theory panel has control to navigate through the presentation slides.











4.1 Whole Numbers

Arithmetical expressions with whole numbers including multiplication and division. Student is required to enter the asked element of multiplication (multiplicand, multiplier, or multiplication product). S/he can use an interactive board as a supporting tool to visualise the multiplication and find the required number. The board at the beginning of the exercise does not explicitly show the multiplier and multiplicand. The student has to select the multiplicand and the multiplier to see the result. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message to the student. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.2 Ordering of Fractions

An educational math game to help you practice fractions. Your goal is to compare and sort the given fractions from the smallest to the greatest.

Student needs to order the 5 given fractions in ascending order. S/he can use the given supporting tool in order to discover which fraction is larger or smaller. The fractions vary from 1 whole to 5th whole. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message to the student. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.3 Calculation with Fractions (addition, subtraction, multiplication, division)

Student will need to perform multiplication, division, subtraction and addition of fractions. This exercise will be using planets in order to engage students in the activity. Each of the arithmetical expressions will have a limited number of exercises (for example 10 per each expression). Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message to the student. Also, the appropriate sound will be played to signalise/inform the student on her/his performance







4.4 Comparing Fractions

An educational math game to help you understand the concept of comparing fractions by determining which fraction is least, greater, or equivalent when compared to another.

In the single player mode you play against the computer. There are 10 rounds and you have up to 20 seconds to provide an answer. Your goal is to score the maximum number of points by answering the questions correctly.

In the multiplayer mode you play against your peers. There are 10 rounds and you have up to 20 seconds to provide an answer. Your goal is to score the maximum number of points by answering the questions correctly.







4.5 Conversion of Fractions & Decimal Fractions as Common Fractions

An educational math game to help you practice conversion from decimal number to fraction and vice versa. Your goal is to convert given decimal or fraction to its respective fraction or decimal.

Each time students submit an answer, they are given appropriate feedback which will be directly sent as a private message to the students and also point for each correctly answered round. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.6 Ratio & Proportion

Student is required to scale the given object based on the given factor (percent, fraction, whole number, decimal number). Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message to the student. Also, the appropriate sound will be played to signalise/inform the student on her/his performance







4.7 Linear / Quadrilateral

Student will be asked to calculate from the given equation y points by using x points, interpret the graph, etc. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.













4.8 Derivatives

Given the expression, find the correct solution from the available options:







4.9 Definite Integrals

Given the integral, find the correct solution from the available options:

		0
	$\int \frac{(2x-6)dx}{x^2 - 6x + 25}$	MATHESIS
	a) ln(x2-6x+25)+C b) ln(x2)+C c) 2x-6+C	
	abc	
自己		A A





4.10 Relationships Between Angles

Student is required to select the correct angle provided in degrees from the 4 options given. Each time a student selects an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance. This exercise can also include variation of fractions and percentages. However, the examples below include only degree measurement.







4.11 The Circle & Related Concepts

Student is required to convert degrees into radians and vice versa. Each time a student submits an answer, she/he is given appropriate feedback which will be directly sent as a private message to the student. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.

Radians Conversion – Code Coloring: An educational math game to help you practice conversion from radians to degrees. Your goal is to convert given radians to adequate degrees and then based on the obtained result color the board with the correct colors to reveal hidden picture.

Once, the game is fully loaded you need to convert the given radians into the adequate degrees by using the number pad. Firstly, select degree window you want to enter the number (it is marked with a question mark). Once you clicked on it, it will highlight in green color.







Degrees Conversion – Code Coloring: An educational math game to help you practice conversion from degrees to radians. Your goal is to convert given degrees to adequate radians and then based on the obtained result color the board with the correct colors to reveal hidden picture.

Once, the game is fully loaded you need to convert the given degrees into the adequate radians by using the number pad. Firstly, select radian window you want to enter the number (it is marked with a question mark). Once you clicked on it, it will highlight in green color.











4.12 Regular Polygons I

Student is required to enter the correct number of edges and vertices of a given 2D figure. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.13 Regular Polygons II

Student is required to enter the correct number of edges and vertices and faces of a given 3D figure. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.14 Geometric Constructions

An educational math game to help you understand the concepts of edges, vertices and faces when it comes to 2D and 3D geometrical figures. You have to solve 5 exercise in order to finish the entire game. There is no time limit so please take your time in order to do your best!!! The game can be rested at any point by pressing the RESET button (red button located to the right).







4.15 Calculating Angles Related to Polygons

Student is required to construct the given angle provided in degrees by adjusting the degrees (+/-15 degrees). Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.16 Angle Between Vectors in the Plane

Student is required to calculate angle alpha knowing angle beta. Each time a student submits an answer, s/he is given appropriate feedback which will be directly sent as a private message. Also, the appropriate sound will be played to signalise/inform the student on her/his performance.







4.17 Logical Thinking: Measurement / Comparison / Conversion I

An educational math game to help you practice liquid measurements. Your goal is to fill up an empty container with the required amount of liquid based on the provided amounts of a liquid in the 5 given containers.

Your task is to read the amount of fluid in milliliters in the first container and then convert that amount into deciliters. To do so you need to select the appropriate amounts of fluids from the displayed containers. You can check the current amount of fluid in the last container (remember that it is in milliliters). If you think you have done mistake you can deselect any incorrectly selected container.

The number of correctly selected containers varies between tasks.







4.18 Logical Thinking: Measurement / Comparison / Conversion II

You need to calculate the weight of the object on the left side of the scale in grams (g). Click on any one of the available items to add them to the right side of the scale, until the scale becomes balanced. Sum up the weights of the items you used, to calculate the weight, and enter it using the provided keypad.













4.19 Basic Concepts in Algorithmic Thinking: Sequencing, Selection & Repetition

The vertices of the graph represent countries of Europe. Apply a color on each vertex of the graph. Two vertices connected by an edge must be of different color. When you have colored all vertices, click the light blue button to check your answers.







4.20 Gaussian Elimination

For each group of equations, the student has to apply the Gaussian Elimination method and then choose the correct solution.







4.21 Vector Format in a 3D Coordinate System

An educational math game that will help you enrich your understanding of the Cartesian quadrant grid system. You will practice how to specify each point uniquely by selecting a numerical pair of coordinates in a plane. The plane is composed of 2 dimensions, the x-axis (horizontal line) and the y-axis (vertical line).

The point is then determined as (x, y) coordinates.

To play this game 2 players need to engage. To win you need to guess the position of the enemy's fleet and sunk them as soon as possible.











5. VIDEOS

The following Playlist in Youtube showcases a number of the activities from the MATHESIS Virtual World:

https://www.youtube.com/playlist?list=PLpZ_4DwxHUPw3uNo4L9Ur6s8Aiq2XKjxU







- 6. REFERENCES
 - 1) MATHESIS Portal
 - 2) MATHESIS Facebook
 - 3) MATHESIS Discord
 - 4) <u>Singularity</u>
 - 5) <u>Firestorm</u>
 - 6) <u>Kokua</u>
 - 7) <u>OpenSimulator</u>
 - 8) Diva Distro (D2)
 - 9) <u>Discord</u>





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