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Project Acronym: PAFSE

Project title: Partnerships for Science Education

3D MODELLING TO ADDRESS PANDEMIC CHALLENGES



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Context and relevance for public health education

As technology continues to evolve, virtual / augmented reality and 3D models are becoming much more common across all industries, particularly healthcare. 3D modelling is getting a more prominent role in rehabilitation and health, from improving surgical training to creating better treatment plans. Indeed, it is used intensively in the design of assistive technologies, e.g., prosthetics, orthosis, or even simpler tools/materials to aid in specific activities. Also, modelling is the first concept to be learned regarding 3D printing.

The 3D field is transforming how products are designed, produced, and serviced; and there are many benefits to embrace this field, such as improving an effective and efficient patient care, providing a teaching tool for professionals at all stages of their careers, from students to interdisciplinary teams, planning medical and surgical cases, identifying issues, or demonstrating them to healthcare professionals, improving follow up care, among others. So, how we leverage the potential of 3D modelling to drive innovation is a mandatory topic in science/technology curriculum.

The scenario supports 8th grade science and ICT teachers in exploring 3D environments using updated scientific/technical evidence. The learning experience supports youths in understanding and reaching high-level comprehension on how STEM (science, technology, engineering, mathematics) may contribute to address these issues, contributing to evidence-based personal decision-making, and public policy.

Estimated Duration

7 classes of 40-45 minutes (lesson 1 – lesson 7)

4 sessions of 40-45 minutes for supplementary learning activities and school project (session 8 – session 11)

Prerequisite knowledge and skills

Basic ICT notions

Classroom organization requirements

ICT classroom with access to computers.

To carry out the research project, students will work in groups of 4 or 5 elements. It is necessary to have a computer/tablet with internet access.

Content glossary

3D Environment. 3D environment is the generation of realistic computer-controlled digital settings for games, film, architectural renderings, and advertising using specialized computer software.

3D Modelling. 3D modeling is the process of creating a 3D representation of any surface or object by manipulating polygons, edges, and vertices in simulated 3D space. 3D modeling is achieved manually with specialized 3D production software that lets an artist create and deform polygonal surfaces, or by scanning real-world objects into a set of data points used to represent the objects digitally.

Collaboration. A recognized relationship among different sectors or groups, which have been formed to take action on an issue in a way that is more effective or sustainable than might be achieved by the public health sector acting alone.

Equity/equitable. Equity means fairness. Equity in health means that peoples' needs guide the distribution of opportunities for well-being. Inequities occur as a consequence of differences in opportunity, which

result, for example in unequal access to health services, nutritious food or adequate housing. In such cases, inequalities in health status arise as a consequence of inequities in opportunities in life.

Health. A state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity.

Multimedia Contents. Multimedia refers to various types of media content, used together. Multimedia content includes text, graphic image files, audio files, video clips.

Public health. An organized activity of society to promote, protect, improve, and – when necessary – restore the health of individuals, specified groups, or the entire population. It is a combination of sciences, skills and values that function through collective societal activities and involve programmes, services and institutions aimed at protecting and improving the health of all people.

Rendering Process. 3D rendering is the process of using a computer to generate a 2D image from a digital three-dimensional scene. To generate an image, specific methodologies and special software and hardware are used.

Research. Activities designed to develop or contribute to knowledge, e.g., theories, principles, relationships, or the information on which these are based. Research may be conducted simply by observation and inference, or by using experiment, in which the researcher alters or manipulates conditions in order to observe and study the consequences of doing so.

Virtual Reality. Virtual reality is the use of computer technology to create simulated environments. Virtual reality places the user inside a three-dimensional experience and, instead of viewing a screen in front of them, users are immersed in and interact with 3D worlds by using special equipment.

Pedagogical glossary

Active Learning. A teaching and learning approach that “engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work”.

Brainstorming: An instructional technique with several variations, that might take place within small group or with the entire class. During brainstorming all students shortly express their ideas or concepts which are relevant to a given guiding question or central term. Criticism on the ideas is absent during brainstorming and its aim is the production of a lot and divergent ideas.

Critical Thinking. The mental processes used when evaluating information that has been put forth as true. Consists of reflection, examination, and formation of judgement. Information is gathered through communication, experience, reasoning and observation. While based in values of intellect, critical thinking goes beyond subject/matter division.

Collaborative Learning. An umbrella term that covers many different methods in which students work together to solve a problem, complete a task, or create a product. Collaborative learning is founded in the concept that learning and knowledge building is social and requires active engagement from students.

Debate Technique. A verbal technique used with the purpose of involving a group in a certain theme that will be exposed. This technique consists of dividing two or more subgroups in which each one participates in the discussion of a general theme and in the construction of a “general commitment” of all.

Group Work. Deepens knowledge, develops research and problem-solving skills; develops attitudes of participation, cooperation, creativity and collaboration; develops teamwork attitudes, social skills and knowledge.

Information. Facts, ideas, concepts and data that have been recorded, analyzed, and organized in a way that facilitates interpretation and subsequent action.

Inquiry based learning. By the term inquiry-based learning we refer to the engagement of students in learning activities during which they practice several scientific inquiry skills. Students make use of these skills in order to answer to scientific questions either posed by the students themselves or by the teacher, by the handling of authentic data, either experimentally collected by themselves or given already collected. Some common inquiry skills include constructing and using models, carrying out experiments, data collection and organization, variable handling, data driven conclusion making and communicating over scientific issues.

Knowledge. A familiarity, awareness or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning.

Pedagogical Techniques. Essential resources that the teacher uses to enhance the pedagogical relationship between the students and the teacher in order to ensure learning. Different forms of application to achieve the objectives of a class.

Project based learning. Project based learning is an instructional model of active learning. It has several forms, during which students work in groups on the development of projects, which often refer to authentic problems or situations approaching real life conditions. Project based learning includes the phases of project initiation, project development and project presentation.

Skill. The ability to carry out a task with pre-determined results often within a given amount of time, energy, or both. Skills can often be divided into domain general and domain-specific skills.

Sources: [EuroHealthNet](#); [Lifewire](#)

Indicative literature

- Ami Chopine, “3D Art Essentials: The Fundamentals of 3D Modeling, Texturing, and Animation”
- Bruna de Freitas Escudeiro e Diego Martins De Pinho, “O Básico da Modelagem 3D com o Blender”
- Flávio Andaló, “Modelagem E Animação 2D E 3D Para Jogos”, ISBN: 8536512059

Principal target:

Science and ICT classes

8th grade (+/- 14 years old students)

ICT teachers integrate other colleagues in the enactment of the scenario (e.g., ICT, visual education, mathematics and English teachers), as it aims to be interdisciplinary.

Competences / Learning Goals

Key Competences

STEM / Personal, social and learning to learn

Knowledge

3D modeling concepts:

- 3D technical principles and workflows.
- Tools for creating 3D models.
- Shortcuts for fast modeling.

Knowledge - outcome assessment:

1. Understands the 3D technical principles and workflows.
2. Recognizes software basic features regarding the interface.
3. Recognizes software basic features regarding shapes.
4. Recognizes software basic features regarding textures and illumination.
5. Recognizes software basic features regarding rendering.
6. Is able to understand the importance of 3D environments to address pandemic challenges and ensure public health.
7. Is able to understand the importance of 3D environments in the health care industry in order to decrease inequality and improve inclusion.

Skills (abilities/competences)

General: Imagination, creativity, 3D basics.

Specific:

- ✓ Designing 3D elements by combining process knowledge, computational design tools, and application requirements.
- ✓ Technical usage of 3D software.

Skills – outcome assessment:

1. Recognizes appropriate proficiencies necessary for 3D modelling.
2. Is able to understand the virtual environment.
3. Can create specific 3D objects and sets.
4. Is able to identify the differences of multiple 3D modelling software.

Affective/Attitudes Behaviour (beliefs)

- ✓ Using imagination for designing real tools and materials.
- ✓ Using creativity skills on new technologies in the development process of the solution.

Attitudes and behavior - outcome assessment:

1. Recognizes the importance of raising awareness on how 3D modelling can help the community.
2. Has intention to continue extending the skills and knowledge regarding 3D modelling.
3. Is aware of the democratization of 3D modelling.
4. Has a positive attitude towards 3D modelling.
5. Believes that is important to improve one's own personal capabilities regarding 3D modelling.

Learning goals and outcomes

- Uses online tools for 3D modelling.
- Analyzes pre-designed models.
- Identifies 3D environments and basic features.
- Designs basic shapes and elements in a 3D environment.
- Exports modeling objects.
- Describes different approaches to create 3D objects for positively influencing global health.
- Gives examples of how 3D models can contribute to improve healthcare environments.

Assessment methods

- ✓ Outcome assessment
 - Qualitative - project: modeling a given 3D object.
 - Quantitative – questionnaire – impact assessment in terms of students knowledge, skills, attitudes and behaviour
- ✓ Process assessment - *assessment of the teaching-learning sequence* – observation grid: reaching the target audience, and extent; implementation of the scenario as planned; run of the learning scenario as expected/organizational issues to be solved; duration of the teaching-learning sequence; number of people exposed; score for likeability – students (“how fun was it to do / how fun would be to do again / how could it be better”).

Content (relevant to learning goals & research topics)

STEM content

- How to use 3D shapes.
- Modelling 3D shapes in digital works. Basic modeling programs.

Non-STEM content

- Brainstorming on 3D approaches and applications in public health.
- Group and public debates.

Digital learning objects

1. 3D modelling software basic features: INTERFACE (video and tutorial).
2. 3D modelling software basic features: SHAPES (video and tutorial).
3. 3D modelling software basic features: TEXTURES and ILLUMINATION (video and tutorial).
4. 3D modelling software basic features: RENDERING (video tutorial).
5. Questionnaire – quantitative assessment of learnings.

Digital educational resources

1. Introduction of virtual environments (video and PowerPoint).
2. Introduction of 3D modelling and principles (infographic).
3. Benefits of 3D modelling in healthcare environments (infographic).
4. Introduction of 3D modelling for product design in healthcare (infographic).
5. Pedagogical glossary for technical terms and definitions (infographic).
6. Introduction of 3D modelling and principles (Powerpoint with infographic).
7. 3D models and environments (videos)
8. Presentation on Basic variables - X, Y, Z (infographic)
9. Show different basic objects to model in 3D (infographic)

Available resources (link) :

Photodentro Repository (<http://photodentro.pafse.eu>)

Teaching-learning activities

Lesson 1: Introduction of virtual environments

The teaching-learning script starts with a question “what is a virtual environment (V.E.)”?

- brainstorming on the questions: “what is a virtual environment?” and “how can modelling be a convergence point for STEM?”.

Students are divided into groups and asked to Google key definitions of virtual environments and their impact on STEM. Each group should produce at least three different sentences; read them and select the main keywords for sharing. Then, students are asked to go to the flipchart or whiteboard and write the main keywords selected.

The next step is a video presentation about virtual environments. After, a discussion is mandatory about their previous definitions and keywords and their recent new knowledge about the topic learned.

Lesson 2: The benefits of 3D modelling in healthcare during / after a pandemic event

After a short conversation about the previous lesson, the benefits of 3D modelling in healthcare are presented.

- digital educational resources: benefits of 3D modelling in healthcare environments; introduction of 3D modelling for product design in healthcare.

After the brainstorm on what is a virtual environment, students are provided with infographics on how these environments can contribute positively to the healthcare industry. Examples: in rehabilitation, surgical training, treatment plans, assistive technologies, (prosthetics, orthosis), product design and production, patient care.

- group discussion around the question “What did Covid-19 change in my life?”

Students are asked to share their own experiences during and after the first outbreak of Covid-19. The main goal is to understand their awareness of the depth the pandemic event had in their lives and channel their responses towards the demands of the healthcare sector, to help them understand how virtual environments could help mitigate issues / challenges in healthcare.

- debate around the question “How can 3D modelling help with pandemic challenges?”

Students are asked to break into groups and each group must provide an example on how 3D modelling can tackle one specific pandemic issue, namely identify specific products that can be modelled and produced for that end, supporting arguments and counter-arguments. Example: products for improving health care and quality of life after a pandemic event, e.g., help in the treatment of depressive symptoms, prolonged stress, anxiety, insomnia, denial, fear, and anger.

Lesson 3: Introduction 3D modelling and principles

After a short conversation about the previous lesson, 3D principles and approaches are presented to be discussed.

- digital educational resource: 3d modelling introduction (PowerPoint)

Introduction on 3D modelling with a small PowerPoint presentation with several examples. Students will experiment a virtual environment using a headset apparatus and proper software. Furthermore, several videos regarding 3D models and environments will be presented.

- digital educational resource: pedagogical glossary for technical terms and definitions
- digital educational resource: 6 Key principles for 3D (video)

Six principles for 3D modelling will be revealed: 1. FORM; 2. DETAIL; 3. SCALE; 4. ADAPTATION; 5. REUSE; 6. SURFACE QUALITY.

Basic variables (X, Y, Z) are presented and correlated with horizontality, verticality and depth. Simple exercises will be done, and replicated by the students, demonstrating the variables.

- group discussion: “How can we design this object in 3D? E.g., surgical mask.”

The aim is to show different basic objects and discuss and reveal which basic elements can be used to model the objects shown. Students may compare different models of the same object and be aware of: the differences they have in the meshes; what benefits and limitations each one has; what situations each model are more suitable for. Also, they must recognize the limitations of scientific models and their differences between real-world objects.

Lesson 4: 3D modelling software basic features: INTERFACE

The teaching-learning script starts with the presentation of the software interface, providing an individual hands-on approach.

- digital educational resource: 3D modelling tutorial about software interface (video)

A video on the software’s interface and major features will be shown. After, individually, students will replicate some basic functionalities in the computer: first approach of the software environment and features.

- learning object: learning object: 3D modelling tutorial about software interface (Tutorial)

After this first approach, a simple tutorial will be provided and students will autonomously and individually follow it, step by step.

- debate around the questions:
 - “What were the software presented?”
 - “Are there only paid software for 3D modelling?”
 - “Which are the major features of the software?”

Lesson 5: 3D modelling software basic features: SHAPES

Students are introduced to geometric representation of models in 3D environment.

- digital educational resource: types of shapes (infographic)
- learning object: tutorial (step by step)
- group work (the availability of laptops or tablets for group work is required)

Students are organized in groups (1 group – 1 Object) and invited to explore shapes in the creation of simple daily objects. After, they will present their work to the colleagues.

Lesson 6: 3D modelling software basic features: TEXTURES and ILLUMINATION

- learning objects: 3D modelling tutorial about textures (video and tutorial)

Students have an overview about the application of simple textures in objects by watching a video. Then, following a step-by-step tutorial, they will experiment to apply texture in objects previously modelled.

- digital educational resource: 3D modelling illumination (video)

As illumination plays a major role in realism on 3D environments, some basic aspects about illumination will be presented to the students.

Lesson 7: 3D modelling software basic features: RENDERING

To finalize the first complete exercise in 3D modelling environment, students will learn what is the process of RENDER.

- digital educational resource: 3D RENDER (manual)
- Quantitative assessment – questionnaire – impact assessment in terms of students knowledge, skills, attitudes and behaviour
- Presentation and Activity in groups (also works as qualitative assessment):

Students must present their modelling objects in groups and, for each presentation, the other colleagues will need to identify which features, shapes and textures were used or which other solutions may be used to improve to object presented.

Lesson 7-forward:

After building and presenting their work, students are challenged to model other 3D objects in groupwork. This is the **School Project** described below.

Supplementary educational activities

Lesson 8, devoted to the preparation of the school project, includes:

1. Teleconference with STEM professionals (e.g., Engineers, Designers Medical Doctors, or researchers of PAFSE consortium):

Students make questions to experts with a particular focus on: a) future academic choices and career paths; b) identifying new professions in new fields of industry 4.0.

2. Visit to FABLAB:

Students make questions to experts with a particular focus on tools and materials to create 3D scenarios. These activities are relevant for students' connections with possible STEM curriculums and careers. Students are shown the working environment and dynamic of a FABLAB.

School Research Project

Topics

Importance of 3D modelling
Technical features and principles of 3D modelling
Possible applications of 3D modelling in public health

Challenge: Model a 3D object to address communicable diseases challenges.

Method: Lesson 8 to 11 will be dedicated to the school research project. Students are organized in groups; each group addresses 1 object based on the daily pandemic challenges lived. The project challenges each group of students to: 1) identify and represent their progress in the form of essay responses and using Likert scales to show their improvement from the first lesson to the last; 2) model and present an object with what they have learned throughout the teaching-learning sequences and the ideas that emerged during the teleconference with experts. A competition and reward for the best 3D objects will take place.

Teaching-learning process milestones:

1. Students will be able to propose solutions for 3D modelling basic objects (masks, ventilators...).
2. Students will be able to communicate the findings, motivations and limitations of various 3D elements and shapes considered in the working process.

3. Students will be able to identify and communicate the importance of 3D modelling to address pandemic challenges but also the role of Innovation.
4. Students will be able to use technical argumentation to justify policy choices.

Teaching-learning process for school project (summary):

1. Development of materials (videos, tutorials, pictures).
2. 3D modelling objects.
3. Presentation of the 3D objects in an open schooling event.

Organization of the open schooling event:

1. Each project output (3D object) is presented by the students in a community setting (e.g., exposition center, municipality, garden, museum, science fair) in a 3D prepared environment (all apparatus included).
2. Students will prepare a pitch on how 3D modelling can address pandemic challenges. Technical talks to motivate peers regarding new technologies and environments are also implemented.
3. Students, parents, the school community and relevant local stakeholders attend the event and are introduced on the topic on how 3D modelling can be used to address pandemic challenges. Furthermore, a multidisciplinary approach is also taken into account, such as the focus on art, design, engineering and mathematics.

Data Analysis and Reporting

Content Analysis.

Presentation formats.

Report writing.

Development of presentation.

Target Audience for Recommendations

School community and local stakeholders: students, parents, municipalities, designers, engineers, and local enterprises.

Public Debate and Recommendations (based on research results)

Presentation of the 3D printing produced by students in a community setting and dissemination of evidence recommendations via social, community and conventional media.

Main partner responsible: INESC-TEC

Assessment Questionnaire- Knowledge, Skills, Beliefs, attitudes and behavior

Scenario topic: 3D modelling

| Knowledge | |
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| 1. Understands the 3D technical principles and workflows | <p>Question 1.1: How many axes can we manipulate in a 3D environment? A) 1. B) 2. C) 3.</p> <p>Question 1.2: What is the coordinate system used in the 3D modelling software? A) Polar coordinate system. B) Cartesian coordinate system. C) Cylindrical and spherical coordinate system.</p> <p>Question 1.3: What are the six key principles for 3D modelling? A) Form, detail, scale, adaptation, reuse, surface quality. B) Scale, reuse, mesh, object, lighting, render. C) Surface quality, texture, image, depth, presentation, apparatus.</p> <p>Question 1.4: Which of the following types of transforms is NOT used in 3D object manipulation: A) Rotation. B) Projection. C) Scale.</p> |
| 2. Recognizes software basic features regarding the interface. | <p>Question 2.1: What is a 3D Viewport? A) It is the area showing objects in rendering-device-specific coordinates, in which the objects of interest are going to be rendered. B) It is a collection of settings that determine model display. C) It is the setup that is required to change the settings of the objects.</p> <p>Question 2.2: What areas of interest are visible in the workspace? A) The viewport and the properties editor. B) The system's preferences and settings. C) All of the above.</p> <p>Question 2.3: Where is the timeline usually displayed? A) At the top. B) At the right sidebar. C) At the bottom.</p> |
| 3. Recognizes software basic features regarding shapes. | <p>Question 3.1: Which one of the following definitions is NOT true. A) A mesh is a 3D object that is made up of components used to form geometric polygons. B) A mesh is the most common type of object in 3D.</p> |

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| | <p>C) A mesh is an empty object that doesn't have any components attached to it.</p> <p>Question 3.2: Identify the three basic components of a mesh.</p> <p>A) Vertices, edges and faces. B) Perspectives, blueprints and vertices. C) Faces, blenders and edges.</p> |
| 4. Recognizes software basic features regarding textures and illumination. | <p>Question 4.1: What are textures in 3D Modelling?</p> <p>A) Textures are flat images that get applied to 3D objects. B) Textures are three-dimensional images that simulate the look of an object. C) Textures are complex images that manipulate lighting.</p> <p>Question 4.2: Is it possible to import different textures simultaneously?</p> <p>A) Yes, using a specific script. B) Yes, using the import specific menu. C) No.</p> <p>Question 4.3: Which are the three types of illumination in 3D?</p> <p>A) Yellow, white and black. B) Light, dark and medium. C) Direct, indirect and global.</p> <p>Question 4.4: What are the names of the three lights in the 3-point lighting technique?</p> <p>A) Overview, spot and shine. B) Key, fill and rim. C) Saturation, contrast and color.</p> |
| 5. Recognizes software basic features regarding rendering. | <p>Question 5.1: What is the goal of the render process?</p> <p>A) To replace real objects with digital information. B) To create objects that will be displayed in the metaverse. C) To simulate digital objects as closer to reality as possible.</p> <p>Question 5.2: Is it possible to render only a portion of the viewport?</p> <p>A) Yes, by choosing the render area option. B) Yes, by choosing the crop image area option. C) No.</p> <p>Question 5.3: Which of the following daily activities can be improved by 3D rendering?</p> <p>A) An architect showing a realistic design of a building. B) A mechanic engineer explaining the shape of a specific motor part. C) All of the above.</p> |
| 6. Is able to understand the importance of 3D | <p>Question 6.1: What artifacts can 3D modelling help design and accelerate their prototyping?</p> <p>A) Personal protective equipment.</p> |

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| <p>environments to address pandemic challenges and ensure public health.</p> | <p>B) Ventilatory support, diagnostic and consumable products. C) All of the above.</p> <p>Question 6.2: Which of the following sentences is NOT true? A) The role of 3D modelling in the hospital environment provides custom-made adaptation of equipment's specifications. B) 3D modelling helps design custom-made solutions that would otherwise be very expensive to prototype. C) None of the above.</p> <p>Question 6.2: Which of the following sentences represent an advantage of 3D modelling in public health? A) 3D modeling offers a way to create detailed spatial representations, achieved quickly and at little cost, and increases resource mapping more effortless. B) 3D modeling helps the designers and end users visualize space requirements, but it reduces drawing efficiency and accuracy. C) 3D modelling only enhances productivity and reduces costs.</p> <p>Question 6.3: Which of the following sentences is NOT true? A) 3D modelling helps improving an effective and efficient patient care through the modelling of custom-made assistive technologies (prosthetics, orthosis, etc). B) 3D modelling helps providing a teaching tool for professionals at all stages of their careers, from students to interdisciplinary teams, planning medical and surgical cases, identifying issues, or demonstrating them to healthcare professionals. C) 3D modelling is a tool much more focused on healthcare industries, but not very commonly used in other fields of interest.</p> |
| <p>7. Is able to understand the importance of 3D environments in the health care industry in order to decrease inequality and improve inclusion.</p> | <p>Question 7.1: What is the main challenge 3D modelling must overcome in order to help decrease inequality in low-income communities' healthcare institutions? A) Lack of trained and skilled modellers that cannot make use of their knowledge for modelling objects that could bring value to the patient care. B) The lack of practical applications of the technology. C) The lack (or inexistence) of free 3D modelling software to accommodate the creation of the designs.</p> <p>Question 7.2: Which of the following sentences represent the truth about the 3D modelling' advantages in education? A) 3D modelling can only be taught to people in high-income communities. B) There is a strong and decisive factor that determines if a person can, or cannot, learn how to 3D model, because not everyone can be taught. C) Everyone can learn how to 3D model, even if they have no background on the matter.</p> |

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| | <p>Question 7.3: Which of the following sentences is NOT true?</p> <p>A) Only people with paid healthcare plans can benefit from 3D modelling if they need a custom-made assistive technology design.</p> <p>B) Every patient can benefit from the 3D model of custom-made assistive technology designs.</p> <p>C) 3D modelling can help accelerate the creation of assistive technology designs during pandemic events and, thus, decrease treatment plans.</p> |
| SKILLS | |
| 1. Recognizes appropriate proficiencies necessary for 3D modelling. | <p>Question 1.1: Which of the following responsibilities is NOT required to be a 3D modeller?</p> <p>A) To create 3D objects based on provided specifications.</p> <p>B) To calculate effort estimations of the objects.</p> <p>C) To refine, optimize or correct 3D models.</p> <p>Question 1.2: Which of the following skills is NOT needed for 3D modelling?</p> <p>A) Knowledge of coding.</p> <p>B) An eye for detail and good visualization skills.</p> <p>C) Knowledge of 3D design tools such as 3DS Max, Maya, Zbrush, Blender.</p> <p>Question 1.3: Which of the following is NOT a type of object that can be 3D modelled?</p> <p>A) Engineering parts.</p> <p>B) Organic objects.</p> <p>C) None of the above.</p> <p>Question 1.4: Which of the following is NOT a benefit of 3D modelling?</p> <p>A) Spot design and drawing errors.</p> <p>B) Quick and accurate visualization.</p> <p>C) Is faster than drawing a sketch.</p> |
| 2. Is able to understand the virtual environment. | <p>Question 2.1: I feel able to understand the coordinate system used in 3D modelling software.</p> <p>1) definitely true... 5) definitely false.</p> <p>Question 2.2: I feel able to navigate the software interface and choose the right tools for the work.</p> <p>1) definitely true... 5) definitely false.</p> <p>Question 2.3: I feel able to adopt 3D modelling to help people visualize abstract concepts. 1) definitely true... 5) definitely false.</p> <p>Question 2.4: Which dimensions of spatial context can be considered when modelling 3D objects?</p> <p>A) Spatial context focused specifically on object properties, object relationships and perception of space.</p> |

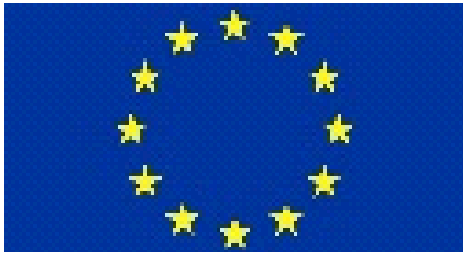
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| | <p>B) Comparison of 2D and 3D map variants. C) Cost of the 3D object's materials and components.</p> <p>Question 2.5: What types of virtual environments are most used to create immersive experiences? A) Virtual reality and mixed reality. B) 2D Videos. C) Social media accounts.</p> <p>Question 2.6: Which of the following is NOT a feature of a 3D interactive environment? A) Create a virtual habitat. B) Have a figurative appearance. C) Create a persona.</p> |
| <p>3. Can create specific 3D objects and sets.</p> | <p>Question 3.1: I feel able to create a 3D object from scratch. 1) definitely true... 5) definitively false.</p> <p>Question 3.2: I feel able to modify object's properties, such as color, texture, shape or size. 1) definitely true... 5) definitively false.</p> <p>Question 3.3: I feel able to create low poly objects, as well as more complex meshes. 1) definitely true... 5) definitively false.</p> <p>Question 3.4: I feel able to determine / alter the lighting setup for 3D objects. 1) definitely true... 5) definitively false</p> <p>Question 3.5: I feel able to create a whole set / scenery involving different 3D elements. 1) definitely true... 5) definitively false.</p> <p>Question 3.6: In order to create a complex object, which of the following solid primitives can be used? A) Cylinder, sphere and torus. B) Pyramid, box and cone. C) All of the above.</p> <p>Question 3.7: Which of the following sentences is NOT true? A) Some actions modify the geometry of the Mesh without changing the overall shape. B) Some actions modify both the geometry of the Mesh and the overall shape. C) It is not possible to modify the geometry of the Mesh nor the overall shape.</p> |

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| <p>4. Is able to identify the differences of multiple 3D modelling software.</p> | <p>Question 4.1: I feel able to identify the differences in the layout / options of distinctive 3D modelling software. 1) strongly disagree... 5) strongly agree.</p> <p>Question 4.2: I feel able to work with / use different 3D modelling software. 1) strongly disagree... 5) strongly agree</p> <p>Question 4.3: I feel able to identify the main limitations, as well as advantages of each distinctive software. 1) definitely true... 5) definitely false.</p> <p>Question 4.4: Which of the following 3D modelling software is more adequate for creating organic objects? A) 3D Studio Max. B) Blender. C) All of the above.</p> <p>Question 4.5: Which of the following 3D modelling software is more adequate for prototyping? A) Maya. B) Solidworks. C) Cinema4D.</p> <p>Question 4.5: Which of the following 3D modelling software is more adequate for creating technical drawings and architectural simulations? A) AutoCAD. B) 3D Studio Max. C) Solid Edge.</p> <p>Question 4.6: Which of the following 3D modelling software is more adequate for creating characters and projecting video games? A) Blender. B) Solid Edge. C) ZBrush.</p> |
| <p>Beliefs, attitudes and behavior</p> | <p>Include: There are no correct or incorrect answers; we are only interested in knowing your perspective.</p> |
| <p>1. Recognizes the importance of raising awareness on how 3D modelling can help the community.</p> | <p>Question 1.1: The creation of 3D objects of my own can contribute to the global society's awareness about the importance of 3D modelling. 1) Extremely unlikely... 5) Extremely likely.</p> <p>Question 1.2: I am able to explain to my family and friends the importance of 3D modelling. 1) strongly disagree... 5) strongly agree.</p> <p>Question 1.3: I feel society takes for granted the benefits of 3D modelling.</p> |

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| | <p>1) strongly disagree... 5) strongly agree.</p> <p>Question 1.4: I think society still does not fully understand the importance of 3D modelling. 1) strongly disagree... 5) strongly agree.</p> <p>Question 1.5: I believe that 3D modelling is important / useful in our daily lives. 1) strongly disagree... 5) strongly agree.</p> |
| 2. Has intention to continue extending the skills and knowledge regarding 3D modelling | <p>Question 2.1: I feel that the 3D modelling process is pleasant and exciting. 1) strongly disagree... 5) strongly agree.</p> <p>Question 2.2: I can imagine a bright future for 3D modelers. 1) Extremely unlikely... 5) Extremely likely.</p> <p>Question 2.3: I feel I have the right profile and attitude to be a 3D modeler in the future. 1) strongly disagree... 5) strongly agree.</p> <p>Question 2.4: I feel highly motivated to pursue a project in this field of expertise. 1) strongly disagree... 5) strongly agree.</p> <p>Question 2.5: I feel curiosity to know more about 3D modelling and improve my skills. 1) Extremely unlikely... 5) Extremely likely.</p> |
| 3. Is aware of the democratization of 3D modelling. | <p>Question 3.1: I feel that the massification of 3D objects is beneficial for society. 1) strongly disagree... 5) strongly agree.</p> <p>Question 3.2: I feel highly motivated to start contributing with my own 3D objects and share them with others with an open-source agreement. 1) Extremely unlikely... 5) Extremely likely.</p> <p>Question 3.3: I agree with the dissemination of 3D objects, free of royalties, to the empowerment of society, as all models should be free to use regardless of the scope. 1) strongly disagree... 5) strongly agree.</p> |
| 4. Has a positive attitude towards 3D modelling. | <p>Question 4.1: For me, the process of 3D modelling is: pleasant : ____ : ____ : ____ : ____ : ____ : unpleasant good : ____ : ____ : ____ : ____ : ____ : bad worthless : ____ : ____ : ____ : ____ : ____ : valuable enjoyable : ____ : ____ : ____ : ____ : ____ : unenjoyable</p> |

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| 5. Believes that is important to improve one's own personal capabilities regarding 3D modelling. | <p>Question 5.1: I feel 3D modelling helps me improve my visual perception. 1) strongly disagree... 5) strongly agree.</p> <p>Question 5.2: I feel 3D modelling helps me expand my knowledge of art. 1) strongly disagree... 5) strongly agree.</p> <p>Question 5.3: I feel 3D modelling helps me to develop my creativity. 1) strongly disagree... 5) strongly agree.</p> <p>Question 5.4: I feel 3D modelling helps me lose my fear of making mistakes. 1) strongly disagree... 5) strongly agree.</p> |
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Partnerships for Science Education



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