GIFTLED

STEAM Education for Gifted Individuals

WP2: Training Resources for Talented Individuals

Giftled Curriculum for Trainers

PROJECT N°:
2022-1-PL01-KA220-SCH-000087644

Co-funded by the European Union

This project has been funded with support from the European Commission.
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Abstract

The document contains the fourth WP2 result: GiftLed Curriculum for trainers.

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Information

Project	GIFTLED - STEAM Education for Gifted Individuals
Project Nº	2022-1-PL01-KA220-SCH-000087644
Work Package	WP2 – Training Resources for Talented Individuals
Date	15/09/2024
Type of Document	Version 1
Language	English

(link web)

Consortium

Akademia Humanistyczno Ekonomiczna w Łodzi

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1. Introduction

A curriculum was developed and designed to demonstrate how the GIFTLED method can be used in STEAM disciplines for inclusion and education of gifted/talented individuals. The curriculum includes content, process and product parts. 7 topics were selected from STEAM disciplines and the content (objectives & topic), process (educational method – learning by design) and product (creative learning products) were demonstrated. The curriculum was developed through the use of previously developed products: augmented reality case studies brochure and Toolkit Introduction Videos (TIVs).

A curriculum describes how to use method GiftLed in "Learning by Design" method in gifted/talented STEAM education to meet special educational necessities of gifted/talented education and their talent development. Curriculum involves content (including objectives), process, and product dimensions of the use of digital and augmented reality toolkit through "learning by design" in STEAM education.

2. Curriculum for Trainers – Giftled Method

The Giftled Method, its idea, concept, methodology and tools, were presented in detail in document "GIFTLED: Learning by Design Method in My Educational Work".

This project proposes a new and innovative enrichment method which aims to foster STEAM education of gifted learners and provide effective resources and tools for teachers of gifted. Considering the gifted learners' differences, abilities, and potentials, the GIFTLED method aims to promote STEAM learning regarding (1) maximum achievement in basic skills, (2) content beyond the prescribed curriculum, (3) exposure to a variety of fields of study in STEAM, (4) student-selected content, (5) high content complexity, (6) experience in creative thinking and problem-solving, (7) development of thinking skills, (8) development of digital literacy skills (9) affective development including intrapersonal and interpersonal, (10) development of productivity, and (10) development of motivation and engagement.

For this aim, firstly, the GIFTLED method adopts the "learning by design" approach as the pedagogical and instructional strategy. It follows and employs the activity types which enable the transformation of knowledge according to gifted learners' skills and potential. In other words, the "learning by design" approach is a strategy for the differentiation of processes in STEAM learning for gifted learners. Secondly, for achieving the above-mentioned aims, the GIFTLED method integrates digital design tools and AR applications. Digital design tools and AR applications are used in the "learning by design" approach in STEAM education. The use of these digital tools is a way to differentiate the learning environment. Teachers will use AR tools in the first three stages of the "learning by design approach". In the fourth stage of the approach, students will use digital design tools (DDTs) for applying the knowledge and design their own creative learning products. The GIFTLED method is visualised in Figure 1. In the

forthcoming parts of the handbook, the teachers will be informed in detail regarding how to use and adapt the GIFTLED method in their STEAM education.

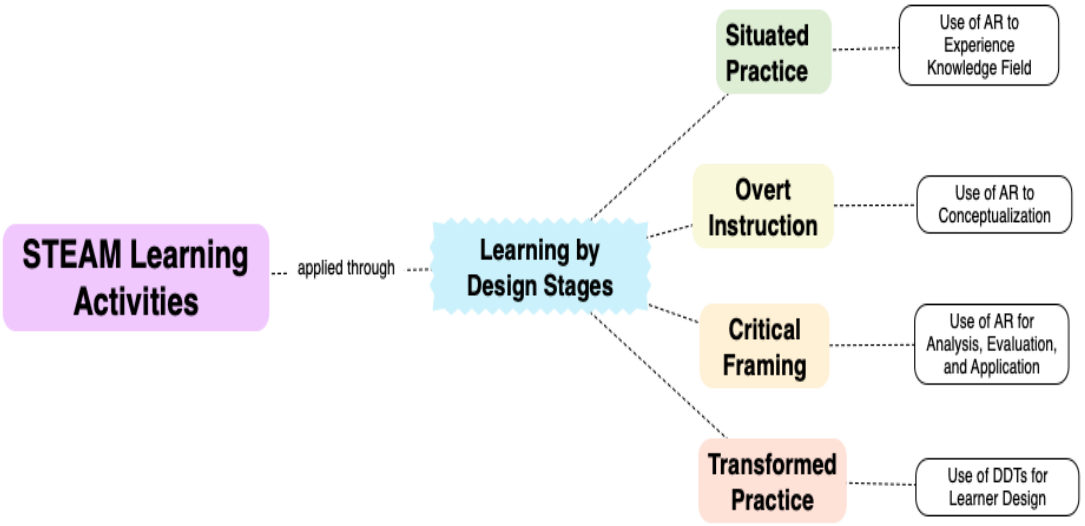


Figure 1: Overview of GIFTLED Method

3. Giftled Curriculum for Trainers

The curriculum shows on how to use GiftLed method in “Learning by Design (LbyD)” method in gifted/talented STEAM education to meet the special educational needs of gifted/talented education and their talent development. The GIFTLED Method is a method which encovers the use of LbyD approach in STEAM education. The AR tools and digital design tools will be used as a tool to perform GIFTLED method in gifted STEAM education. Curriculum involves content (including objectives), process, and product dimensions of the use of digital and augmented reality toolkit through “learning by design” in STEAM education.

The STEAM disciplines, such as science, technology, engineering, art and mathematics, are currently the important components of education process both in primary and secondary schools in each partner countries as well as in all EU countries and also world countries. The different technologies that are developing currently very quickly are based on these disciplines. Especially, the IT and ICT technologies that are present in our public and private life every day are joined with STEAM disciplines.

The GIFTED curriculum is based on Learning by Design method which is a project-based and inquiry-based learning approach that integrates Science, Technology, Engineering, Arts, and Mathematics education with the use of design thinking and problem-solving skills, and also

creativity potentials in STEAM education process. It has to fulfil the standards for gifted education and STEAM education that are as follows:

- provide opportunities for independent research,
- offer advanced coursework,
- create opportunities for hands-on learning,
- encourage interdisciplinary learning,
- provide opportunities for design and problem solving,
- provide mentorship and internships.

Learning outcomes of GIFTED curriculum that the pupils will achieve upon the completion of the whole learning program based on GIFTLED method are the following:

LO1: maximum achievement in basic skills

LO2: content beyond the prescribed curriculum

LO3: exposure to a variety of fields of study in STEAM

LO4: learner-selected content

LO5: high content complexity

LO6: experience in creative thinking and problem-solving

LO7: development of thinking skills

LO8: development of digital literacy skills

LO9: affective development including intrapersonal and interpersonal

LO10: development of productivity and development of motivation and engagement

Moreover, the Industry 4.0 that is currently present in our world and also the Industry 5.0 that is very close and will be present in very near future are based on IT/ICT technologies and STEAM disciplines.

Industry 4.0 or fourth industrial revolution represents the set of terms that describe social, industrial and technological changes brought about by the digital transformation of industry. Industry 4.0 is defined as a modern industry, supported by automation and information technology, new sub-production technologies (3D printing, VR, collaborative robots), IT / communication solutions (Cloud Computing, Big Data, Internet of Things) and enterprise management in the era of new industrial revolution.

The application of Industry 4.0 are as follows: (1) Internet of Things, (2) Data analytics and healthcare optimization, (3) IT integration and creation of cyber-physical systems (CPS), (4) Cybersecurity, (5) Artificial intelligence, (6) Additive printing (3D printing), (7) Digital and

digitization of production, (8) Cloud computing, (9) Big Data, (10) Virtual and augmented reality, (11) Collaborative robots, (12) Mobile robots, (13) RFID, (14) Mobile interfaces, (15) Blockchain, (16) Geolocation.

Title: GIFTLED Learning Program

Level: Primary/secondary school pupils aged 10-18

Primary mode of delivery: Face-to-face

Suggested duration: 4 hours face-to-face contact per week (2 x 2 meetings per week) – over a 7-week period (28 hours in total)

Aim: The principle aim of the GIFTLED curricular learning program is to stimulate interest and competences of gifted/talented individuals in STEAM (Science, Technology, Engineering, Art and Maths) subjects with the use of Learning by Design method. It is based on project-based learning, design thinking and problem-solving skills. This purpose will be archived by introducing the concepts that have real-life applications within the context of Industry 4.0 and smart cities.

Basic resources: AR case studies, Toolkit Introduction Videos (TIVs).

Content: The curriculum is designed to be delivered as 7 face-to-face modules for gifted/talented individuals:

The process proposed by the GIFLED curriculum is based on the Learning by Design approach. The realization of modules listed above have to be done according to this process, described in Chapter 1 of the Giftled Handbook. This process assumes that the first three steps of LbyD approach is done through the use of AR tools (Chapter 5 of the Handbook). The final, fourth, step of LbyD, in which pupils design or produce the problem solutions, is done through the use of Toolkit Introduction Videos (TIVs), presented in Table 1 (described in Chapter 6 of the Handbook).

The solutions and products designed and/or produced by pupils during the realization of the modules can be different. It depends of the case studies proposed in the framework of GIFTLED curriculum and in the framework of teachers' propositions during the lessons with the pupils. However, each time they should be adapted to the knowledge level of pupils, their experience and intelligence.

The AR (augmented reality) application that is suggested to use in the realization of the three first steps of the modules according to the LbyD approach supporting the GIFTLED curriculum

is the Zapworks Designer – Zappar tool (www.zappar.com). Zappar connects the digital world with the things around the user. It's like opening up to another other dimension where everyday things can transform to unlock a video, game, and even 3D characters that user can play with directly.

The STEAM Digital Design Tool that are suggested to use in the implementation of the particular modules were chosen based on their features, functions, free access and moderate difficulties. They together create the GIFTLED Toolkit Introduction Videos (TIVs). The suggested tools are presented in table 1 divided according to the STEAM disciplines.

	STEAM discipline	**STEAM Toolkit Introduction Videos (TIVs) to use**
1	Science	Go-Lab, https://www.tinkercad.com/ Tinkercad, https://www.golabz.eu/
2	Technology/Coding	Code, https://code.org/ Tynker, https://www.tynker.com/
3	Engineering	SketchUp, https://www.sketchup.com/products Algodoo, http://www.algodoo.com/
4	Art	Canva, https://www.canva.com/ Powtoon, https://www.powtoon.com/
5	Mathematics	Geogebra, https://www.geogebra.org/?lang=en Infogram, https://infogram.com/

Table 1. TIVs according to STEAM disciplines suggested for GIFTLED curriculum

It is recommend to realize each module in the form of project realized individually by each pupil or by the small groups of pupils.

The GIFTLED method integrates AR applications and digital design tools which are used in the "learning by design" approach in STEAM education. Teachers will use AR tools in the first three stages of the "learning by design approach", so

1. *Situated Practice* – use of AR to experience knowledge field.
2. *Overt Instructions* - use of AR to conceptualization.
3. *Critical Framing* – use of AR for analysis, evaluation and application.

In the fourth stage of the approach, so *Transformed Practice*, pupils use Toolkit Introduction Videos (TIVs) for applying the knowledge and design their own creative learning products.

Teachers can prepare their own lesson modules based on the materials provided by the GIFTLED project, i.e. the handbook for teachers, case studies and Toolkit Introduction Videos (TIVs), intended for students and teachers.

The guidelines for preparing the modules, i.e. the purpose of the module, learning audience, learning outcomes, learning methods, duration, tools needed, scenario for learning (activities to fulfil for defined learning outcomes), reference materials and background content, evaluation of the module and assessment (multi-choice questions per learning outcome), are described in Annex 1.

Teachers are recommended to use the following template presented in Annex 1 to create their own lesson module:

4. Content of Curriculum Modules

The GIFTLED project has prepared 7 lesson modules, adapted to previously created resources, i.e. case studies and Toolkit Introduction Videos (TIVs), intended for students and teachers. These lessons can be used by teachers together with case studies and TIVs during the lesions with pupils, but they also serve as inspiration for teachers to create their own lessons.

Each module is divided into two lessons to give students adequate time to explore a given topic and teachers time to explain all the nuances of a topic to students.

4.1. Module no 1: Electrical Circuits in Physics

MODULE TITLE	*Understanding Electrical Circuits in Physics through AR and Simulations*
MODULE GOAL(S)	*Module aims to equip learners with skills and knowledge related to understanding electrical circuits in physics. Learners will gain a deeper understanding of how series and parallel circuits function, including their impact on current flow and voltage distribution. They will learn how to adapt theoretical knowledge to practical applications by constructing and analysing simple electrical circuits. The module will help learners acquire the competences necessary to contribute to designing and evaluating effective circuit configurations.*
LEARNING AUDIENCE	• *Educators and teachers responsible for instructing students aged 12-15 years old.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: • *Explain the differences between series and parallel circuits, including how each affects current and voltage.* • *Simulate the construction of series and parallel electrical circuits using PhET simulations.* • *Compare the behaviour of series and parallel circuits in terms of simulated current flow and voltage distribution.* • *Predict the impact of changing resistor configurations (series vs. parallel) on the simulated behaviour of electrical circuits.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study 1 (Electrical Circuits in Physics) to introduce concepts of series and parallel circuits.*

	• ***Interactive Simulations:*** *Use PhET simulations to allow learners to simulate and manipulate series and parallel circuits.* • ***Learning by Design:*** *Engage learners in designing and constructing series and parallel circuits virtually through guided activities and experimentation.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and the PhET Tool" and "Tutorial for PhET Tool") to demonstrate practical applications and tips for using PhET simulations effectively.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing PhET simulations.* • *Projection equipment or screens for displaying the AR Case Study on Electrical Circuits.* • *Access to the AR Case Study 1 (Electrical Circuits in Physics) developed earlier in the project for theoretical introduction.* • *Access to thr Toolkit Introduction videos ("Learning by Design and the PhET Tool" and "Tutorial for PhET Tool").* • *Additional classroom materials such as pens, paper, and whiteboards for group discussions and activities.*
CLASS SESSION 1	***Introduction to Series and Parallel Circuits***
CLASS SESSION GOAL(S)	*Class session 1 provides learners with a comprehensive understanding of series and parallel circuits. Learners will gain insight into the fundamental concepts and principles of how series and parallel circuits affect current and voltage. They will also become familiar with the practical uses of these circuits through simulations, acquiring the knowledge and skills necessary to construct and compare different circuit types.*
LEARNING OUTCOMES	*Upon completing the class session 1, the learners should be able to:* • *Understand the fundamental differences between series and parallel circuits.* • *Explain how these circuits affect current and voltage using the AR Case Study and PhET simulations.* • *Simulate the construction of series and parallel electrical circuits using PhET simulations.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study to introduce concepts of series and parallel circuits.* • ***Interactive Simulations:*** *Use PhET simulations to allow learners to simulate and manipulate series and parallel circuits.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and the PhET Tool" and "Tutorial for PhET Tool") to demonstrate practical applications and tips for using PhET simulations effectively.*

	• ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (10 minutes):*** • *Use the AR Case Study on Electrical Circuits to introduce the fundamental differences between series and parallel circuits.* • *Emphasize how each configuration affects current and voltage.*
	Step 2 – Simulating Circuits with PhET Simulations (30 minutes): • ***Learning Video (10 minutes):*** 1. *Watch the Introduction videos ("Learning by Design and the PhET Tool" and "Tutorial for PhET Tool") to understand how to use PhET simulations effectively for learning about circuits.* • ***Quests-Tasks (20 minutes):*** 1. *Access PhET simulations on a computer or tablet.* 2. *Simulate the construction of series and parallel circuits within the PhET environment.* 3. *Compare the behaviour of these circuits in terms of current flow and voltage distribution.*
	Step 3 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about electrical circuits.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Electrical Circuits (Pages 1, 2, 3)* • *Toolkit Introduction Videos ("Learning by Design and the PhET Tool" and "Tutorial for PhET Tool")* • *PhET Interactive Simulations website for additional resources*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *Which statement correctly describes the main difference between series and parallel circuits in terms of current flow?* 1. *Series circuits have a single pathway for current flow, while parallel circuits have multiple pathways.* 2. *Series circuits have multiple pathways for current flow, while parallel circuits have a single pathway.* 3. *Series circuits and parallel circuits have the same pathway for current flow.* ***Feedback*** 1. *Correct. Series circuits have a single pathway for current flow, whereas parallel circuits provide multiple pathways.* 2. *Incorrect. Series circuits have a single pathway for current flow, not multiple pathways.* 3. *Incorrect. Series and parallel circuits differ in terms of current flow pathways. Series circuits have a single pathway, whereas parallel circuits have multiple pathways.* ***Question 2***

	Why are PhET simulations effective tools for learning about electrical circuits? 1. *They allow us to physically build circuits using real components.* 2. *They provide interactive virtual environments to simulate circuit behaviour.* 3. *They offer theoretical explanations without practical application.* ***Feedback*** 1. *Incorrect. PhET simulations do not involve physical components. Instead, they provide virtual environments for simulating circuit behaviour.* 2. *Correct. PhET simulations offer interactive virtual environments where we can simulate and manipulate circuits, aiding in understanding circuit behaviour practically.* 3. *Incorrect. PhET simulations are interactive and provide practical simulations, not just theoretical explanations.* ***Question 3*** *What is the primary advantage of using the AR Case Study in learning about series and parallel circuits?* 1. *It provides hands-on experience with physical circuit components.* 2. *It offers visual and interactive explanations of circuit concepts.* 3. *It focuses on theoretical discussions without practical application.* ***Feedback*** 1. *Incorrect. The AR Case Study does not involve physical components but rather provides visual and interactive explanations.* 2. *Correct. The AR Case Study offers visual and interactive explanations of circuit concepts, enhancing understanding through engagement with augmented reality.* 3. *Incorrect. The AR Case Study integrates practical visual and interactive elements, not just theoretical discussions.*
CLASS SESSION 2	***Engaging in Learning by Design Activities***
CLASS SESSION GOAL(S)	*Class session 2 aims to equip learners with skills and knowledge related to designing and analysing electrical circuits. Learners will gain a deeper understanding of series and parallel circuits through hands-on design activities and simulations. They will learn how to apply their theoretical knowledge to predict the impact of changing resistor configurations and relate their learning to real-life applications.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Simulate the construction of series and parallel electrical circuits using PhET simulations.* • *Compare the behaviour of series and parallel circuits in terms of simulated current flow and voltage distribution.* • *Predict the impact of changing resistor configurations (series vs. parallel) on the simulated behaviour of electrical circuits.*

LEARNING METHODS	• ***Interactive Simulations:*** *Continue using PhET simulations to allow learners to explore and refine their understanding of circuit behaviour through hands-on virtual experimentation.* • ***Learning by Design:*** *Engage learners in designing and constructing series and parallel circuits virtually through guided activities and experimentation.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Recap the Key Points (5 minutes):*** • *Briefly review the key points learned in the previous class session.*
	Step 2 – Learning Activities (20 minutes): • *Engage in Learning by Design activities where learners will design and construct virtual series and parallel circuits using PhET simulations.*
	Step 3 – Reflection (5 minutes): • *Discuss in groups the predictions made and observations noted during the simulation activities.* • *Reflect on how these observations align with theoretical knowledge.*
	Step 4 – **Real-life examples** ***(10 minutes):*** • *Discuss real-life examples where series or parallel circuits are used, reinforcing theoretical concepts with practical applications.* *Examples:* ***Series Circuits:*** • *Christmas Lights: Older strings of lights where one bulb out means the whole string goes out.* • *Smoke Detectors: Systems where triggering one detector completes the circuit for the alarm.* ***Parallel Circuits:*** • *Household Wiring: Electrical outlets and appliances that operate independently.* • *Battery Backup Systems: Batteries connected in parallel for increased capacity and longer duration.*
	Step 5 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about electrical circuits.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Slides summarizing key points from the first session and introducing new activities and examples* • *PhET Interactive Simulations website for additional resources* • *Real-Life Examples of Series and Parallel Circuits*
EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** *How does engaging in Learning by Design activities contribute to your understanding of series and parallel circuits?* 1. *It reinforces theoretical concepts through practical application.*

	2. *It excludes the use of simulations, focusing solely on theoretical discussions.* 3. *It limits your exploration of circuit behaviour.* ***Feedback*** 1. *Correct. Engaging in Learning by Design activities allows you to apply theoretical knowledge practically, enhancing your understanding of circuit behaviour. This is because...* 2. *Incorrect. Learning by Design activities involve practical application through simulations, not excluding them for theoretical discussions alone. This is because...* 3. *Incorrect. Learning by Design activities encourage exploration and application of circuit behaviour through simulations. This is because...* ***Question 2*** *Why is it important for us to discuss real-life examples of series and parallel circuits?* 1. *To relate theoretical knowledge to practical applications.* 2. *To avoid engaging in practical activities.* 3. *To limit our understanding of circuit concepts.* ***Feedback*** 1. *Correct. Discussing real-life examples helps us relate theoretical knowledge to practical applications, reinforcing our understanding of circuit concepts. This is because...* 2. *Incorrect. Discussing real-life examples enhances understanding by bridging theoretical knowledge with practical applications, rather than avoiding practical activities. This is because...* 3. *Incorrect. Discussing real-life examples expands understanding of circuit concepts, rather than limiting it. This is because...* ***Question 3*** *What role do group discussions play in our learning about series and parallel circuits?* 1. *They hinder reflection on simulation results.* 2. *They encourage collaboration and deeper understanding.* 3. *They limit interaction with PhET simulations.* ***Feedback*** 1. *Incorrect. Group discussions actually encourage reflection on simulation results, fostering deeper understanding.* 2. *Correct. Group discussions promote collaboration and deeper understanding of circuit concepts by sharing insights and reflections on simulation activities.*

	3. *Incorrect. Group discussions complement interaction with PhET simulations by providing opportunities for reflection and collaborative learning.*

4.2. Module no 2: From Caves to Modernity

MODULE TITLE	*Experiencing Art through Augmented Reality*
MODULE GOAL(S)	*The goal of this module is to give students the information and abilities necessary to comprehend art and how it affects the society. Students will gain an understanding of how to apply theoretical knowledge to real-world situations via critical thinking and analysis of selected works of art. They will acquire a more profound comprehension of art history, along with its influence on contemporary art forms. Module will assist students in gaining the skills required to participate in the creation and assessment of the art.*
LEARNING AUDIENCE	• *Educators are in charge of instructing students between the ages of 12 and 15.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to:* • *List the styles in art.* • *Know the features of different art styles.* • *Recognize works of art, their motifs and finding learner's own meaning to them.* • *Become familiar with the most well-known artists from various eras.*
LEARNING METHODS	• ***Introducing Basics:*** *Use of the AR Case Study 2 (From Caves to Modernity) to introduce basics of art.* • ***Working in Groups****: Cooperate together in a group of few students to realize the common art project.* • ***Learning by Design:*** *Using experimentation and guided exercises, students create their own artwork in a selected style.* • ***Video-Based Learning:*** *Use instructional videos (Learning By Design and Canva Tool and Tutorial for Canva Tool) to demonstrate practical applications and tips for using Canva design tool effectively.* • ***Conclusions:*** *Organize discussion in groups to analyse artistic creations.*
DURATION:	*Two class lessons (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing Canva tool.* • *Equipment (computers, tablets or projection equipment) for displaying the AR Case Study on Art.* • *Access to the AR Case Study 2 (From Caves to Modernity) developed earlier in the project for theoretical introduction.*

	• *Access to the Toolkit Introduction videos (Learning By Design and Canva Tool and Tutorial for Canva Tool).* • *Extra tools like phones, whiteboard, pens, paper, etc., for group projects and discussions.*
CLASS SESSION 1	***Introduction to Exploring Art***
CLASS SESSION GOAL(S)	*First lesson gives students a thorough overview of art styles in the history of art over the centuries. Students will acquire understanding of the basic ideas and rules of art. Through exercises, they will also learn about the real-world applications of these genres and gain the information and abilities needed to evaluate various works of art.*
LEARNING OUTCOMES	*After completing the first lesson, students ought to be able to:* • *Understand the fundamental differences between art styles existing in art history.* • *Model critical thought regarding selected pieces of art using the AR Case Study and Canva tool.* • *Explain how these artworks affected and affect people over the centuries.*
LEARNING METHODS	• ***Introducing Basics:*** *Use of the AR Case Study to introduce art styles.* • ***Art Design:*** *Use Canva tool to allow learners to design and create the first art project.* • ***Video-Based Learning:*** *Use instructional videos (Learning By Design and Canva Tool and Tutorial for Canva Tool) to demonstrate practical applications and tips for using Canva tool effectively.* • ***Discussions:*** *Begin class conversations and discussions based on students' observations.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (15 minutes):*** • *Use the AR Case Study on Art (From Caves to Modernity) to introduce the fundamentals of art* • *Highlight which traits belong to which styles.*
	Step 2 – Real-life examples (10 minutes): • *Talk about examples in real life where art is employed. How it can affect people and their emotions?* • *Use the Toolkit Introduction Videos (Learning By Design and Canva Tool) to introduce the idea of Learning by Design concept.*
	Step 3 – Educational exercises (15 minutes): • *Let students use apps like Google Arts & Culture or "DALL-E" to choose their favourite pieces of art and describe them on paper.*
	Step 4 – Conclusions (5 minutes): • *Review the main concepts learned about art.* • *Engage students into discussions about their learning experience.*

REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Art (Pages 1, 2, 3)* • *Toolkit Introduction Videos (Learning By Design and Canva Tool and Tutorial for Canva Tool)* • *Canva tool website for additional resources*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *What is the significance of cave paintings in prehistoric times? Did they serve as early forms of communication?* 1. *Cave paintings are believed to be documenting important events, depicting religious or ritualistic practices, and possibly conveying information about hunting and daily life.* 2. *Cave paintings were purely decorative and served no specific purpose other than to beautify living spaces.* 3. *Cave paintings were only created by children as a form of early play and had no actual context.* ***Answer*** 1. *Correct. They served as both a visual record and a tool for cultural transmission.* 2. *Incorrect. They often depicted scenes of hunting, daily life, and spiritual beliefs, which were important to the communities that created them.* 3. *Incorrect. Evidence suggests that cave paintings were created by skilled adults, serving purposes such as ritualistic practices, storytelling.* ***Question 2*** *How did the invention of photography influence the development of art? Did it let to the decline of traditional painting?* 1. *Photography replaced traditional painting entirely because artists no longer needed to paint realistic scenes.* 2. *The invention of photography revolutionized art by providing a new medium for capturing reality, leading to the rise of new artistic movements.* 3. *The invention of photography had no significant impact on the development of art.* ***Answer*** 1. *Incorrect. While photography did impact traditional painting, it did not replace it.* 2. *Correct. Photography's ability to capture precise details led painters to explore other styles.* 3. *Incorrect. It challenged artists to rethink their approaches to representation and spurred the development of new art movement.*
CLASS SESSION 2	***Learning by Design Activities***
CLASS SESSION GOAL(S)	*The second class session's objective is to provide students with the knowledge and skills necessary to create their original artwork. The*

	ability to apply theoretical information to their own artwork and connect learning about practical application will be offered to the learners. They should gain a deeper understanding how art can influence our current life and help in learning and working in holistic manner.
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Design original artwork in style of their choice with the use of Canva tool supported by other art design tools if needs.* • *Learn how tools like Canva, with intuitive interface, ready-made templates and rich library of graphic resources, allow us to create professional graphic designs and projects without the need for advanced design skills.* • *Personal enrich themselves, understanding cultures and appreciating aesthetics over the centuries.*
LEARNING METHODS	• ***Art Project Design:*** *Realize a full art project design with the use of Canva to allow the students to know and explore the information about design and creation of arts in different styles.* • ***Learning by Design:*** *Engage learners in designing their own art project in groups through guided activities and teacher support in solving any problems.* • ***Conclusions:*** *Organize discussion in groups to conclude the effect of art project on them.*
SCENARIO FOR LEARING:	***Step 1 – Review the Concepts (5 minutes):*** • *Go over the main ideas covered in the prior class session.* • *Use the Toolkit Introduction Videos (Tutorial for Canva Tool) to introduce the Canva Tool.*
	Step 2 – Learning activities (30 minutes): • *Divide learners into 4-5-person teams, giving the teams different art styles to draw using Canva tool and represent later.* • *Engage the students in Learning by Design activities and make sure each student in team has to draw some part of the drawing.* • *Discuss in groups the predictions made and observations noted during the project realization.*
	Step 3 – Presentation and summary (10 minutes): • *Each team picks one person to represent their artwork in front of the class.* • *Encourage students to reflect on what they have learned and summarize the lessons.* • *Recap the key points the students learned about art.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Display providing exercises and reviewing the main ideas from the first lessons.* • *Canva tool website and videos for additional resources* • *Toolkit Introduction Videos (Learning By Design and Canva Tool and Tutorial for Canva Tool)* • *Real-life art examples.*

EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** *What is the impact of Learning by Design exercises on your comprehension of art?* 1. *Through real-world application, theoretical principles are reinforced.* 2. *It only discusses theory and leaves out any real-world application.* 3. *It restricts your ability to explore art.* ***Answer*** 1. *Correct. Engaging in Learning by Design activities allows you to apply theoretical knowledge practically, enhancing your understanding of art. This is because...* 2. *Incorrect. Learning by Design activities involve practical use, not excluding them for theoretical discussions alone. This is because...* 3. *Incorrect. Learning by Design activities encourage exploration art. This is because...* ***Question 2*** *Why is it crucial for us to discuss past art styles?* 1. *To understand past societies and their people.* 2. *To refrain from doing actual tasks.* 3. *To restrict our comprehension of art.* ***Answer*** 1. *Correct. Discussing real-life examples helps us relate theoretical historic knowledge, reinforcing our understanding of art. This is because...* 2. *Incorrect. Discussing real-life examples enhances understanding by bridging theoretical knowledge with practical use, rather than avoiding practical activities. This is because...* 3. *Incorrect. Discussing real-life examples expands understanding of art, rather than limiting it. This is because...* ***Question 3*** *What role do group working and discussions play in our learning about art?* 1. *They make it difficult to reflect.* 2. *They limit our imagination.* 3. *They promote cooperation and deeper knowledge.* ***Answer*** 1. *Incorrect. Group working and discussions actually encourage reflections, fostering deeper understanding.* 2. *Incorrect. Group working and discussions actually encourage reflections, fostering deeper understanding and imagination.* 3. *Correct. Group discussions promote collaboration and deeper understanding of art by sharing insights and reflections.*

4.3. Module no 3: Wind Turbines

MODULE TITLE	*Understanding how Wind Turbines Work*
MODULE GOAL(S)	*This module aims to equip learners with skills and knowledge related to understanding how wind turbines generate electricity. Learners will gain a deeper understanding of how wind turbines function, including their specifications to be most effective. They will learn how to adapt theoretical knowledge to practical applications by constructing and analysing a wind turbine. The module will help learners acquire the competences necessary to contribute to designing and evaluating effective wind turbines.*
LEARNING AUDIENCE	• *Educators and teachers responsible for instructing students aged 16-18 years old.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: • *Explain the differences between onshore and offshore wind turbines.* • *Simulate the construction of a wind turbine using SketchUp.* • *Compare onshore and offshore wind turbines.* • *Point out the characteristics of wind turbines which generate electricity.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study 3 (Understanding Wind Turbines) to introduce wind turbine concepts* • ***Interactive Simulations:*** *Use SketchUp to allow learners to simulate and manipulate a wind turbine.* • ***Learning by Design:*** *Engage learners in designing and constructing a wind turbine virtually through guided activities and experimentation.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and SketchUp Tool" and "Tutorial for SketchUp Tool") to demonstrate practical applications and tips for using SketchUp simulations effectively.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing SketchUp.* • *Projection equipment or screens for displaying the AR Case Study on Wind Turbines.* • *Access to the AR Case Study 3 (Understanding Wind Turbines) developed earlier in the project for theoretical introduction.* • *Access to the Toolkit Introduction videos ("Learning by Design and SketchUp Tool" and "Tutorial for SketchUp Tool").* • *Additional classroom materials such as pens, paper, and whiteboards for group discussions and activities.*

CLASS SESSION 1	***Introduction to Wind Turbines***
CLASS SESSION GOAL(S)	*Class session 1 provides learners with a comprehensive understanding of wind turbines. Learners will gain insight into the fundamental concepts and principles of how wind turbines generate electricity. They will also become familiar with the components of wind turbines through simulations, acquiring the knowledge and skills necessary to construct wind turbines.*
LEARNING OUTCOMES	*Upon completing the class session 1, the learners should be able to:* • *Understand the fundamental components of a wind turbine* • *Explain how these wind turbines generate electricity using the AR Case Study and Sketchup.* • *Simulate the construction of a wind turbine using SketchUp.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study to introduce concepts of wind turbines* • ***Interactive Simulations:*** *Use SketchUp to allow learners to simulate and manipulate wind turbines.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and SketchUp Tool" and "Tutorial for SketchUp Tool") to demonstrate practical applications and tips for using SketchUp simulations effectively.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (10 minutes):*** • *Use the AR Case Study on Wind Turbines to introduce the fundamental elements and types of wind turbines.* • *Emphasize how each configuration affects current and voltage.*
	Step 2 – Simulating with SketchUp (30 minutes): • ***Learning Video (10 minutes):*** 1. *Watch the Introduction videos ("Learning by Design and SketchUp Tool" and "Tutorial for SketchUp Tool") to understand how to use SketchUp for effective learning.* • ***Quests-Tasks (20 minutes):*** 1. *Access SketchUp on a computer or tablet.* 2. *Simulate the construction of a wind turbine using SketchUp.* 3. *Observe what is required to construct a functional wind turbine*
	Step 3 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about wind turbines.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Wind Turbines (Pages 1, 2, 3)* • *Toolkit Introduction Videos ("Learning by Design and SketchUp Tool", "Tutorial for SketchUp Tool")* • *SketchUp website for additional resources*

EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *Which statement correctly describes the main difference onshore and offshore wind turbines?* 1. *Offshore wind turbines are generally larger and produce more electricity due to stronger and more consistent winds compared to onshore wind turbines.* 2. *Onshore wind turbines are found on the sea while offshore wind turbines are found on land.* 3. *Onshore wind turbines are more expensive to build and maintain than offshore wind turbines.* ***Feedback*** 1. *Correct. Offshore wind turbines are generally larger and produce more electricity due to stronger and more consistent winds compared to onshore wind turbines.* 2. *Incorrect. Onshore wind turbines are found on land while offshore wind turbines are found in the sea.* 3. *Incorrect. Offshore wind turbines are more expensive to build and maintain than onshore wind turbines.* ***Question 2*** *Why is SketchUp an effective tool for learning about wind turbines?* 1. *They allow us to physically build wind turbines using real components.* 2. *They provide interactive virtual environments to simulate wind turbines.* 3. *They offer theoretical explanations without practical application.* ***Feedback*** 1. *Incorrect. SketchUp does not involve physical components. Instead, it provides virtual environments for simulating wind turbines.* 2. *Correct. SketchUp offers interactive virtual environments where we can simulate and manipulate wind turbines, aiding in understanding wind turbines practically.* 3. *Incorrect. SketchUp is an interactive and provide practical simulations, not just theoretical explanations.* ***Question 3*** *What is the primary advantage of using the AR Case Study in learning about wind turbines?* 1. *It provides hands-on experience with wind turbine components.* 2. *It offers visual and interactive explanations of wind turbine concepts.* 3. *It focuses on theoretical discussions without practical application.* ***Feedback***

	1. *Incorrect. The AR Case Study does not involve physical components but rather provides visual and interactive explanations.* 2. *Correct. The AR Case Study offers visual and interactive explanations of wind turbine concepts, enhancing understanding through engagement with augmented reality.* 3. *Incorrect. The AR Case Study integrates practical visual and interactive elements, not just theoretical discussions.*
CLASS SESSION 2	***Engaging in Learning by Design Activities***
CLASS SESSION GOAL(S)	*Class session 2 aims to equip learners with skills and knowledge related to designing and analysing wind turbines. Learners will gain a deeper understanding of onshore and offshore wind turbines through hands-on design activities and simulations. They will learn how to apply their theoretical knowledge when constructing a wind turbine to generate electricity and relate their learning to real-life applications.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Simulate the construction of wind turbines using SketchUp.* • *Be aware of the elements and conditions needed for wind turbines to function.*
LEARNING METHODS	• ***Interactive Simulations:*** *Continue using SketchUp to allow learners to explore and refine their understanding of wind turbines through hands-on virtual experimentation.* • ***Learning by Design:*** *Engage learners in designing and constructing wind turbines virtually through guided activities and experimentation.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Recap the Key Points (5 minutes):*** • *Briefly review the key points learned in the previous class session.*
	Step 2 – Learning Activities (20 minutes): • *Engage in Learning by Design activities where learners will design and construct wind turbines using SketchUp*
	Step 3 – Reflection (5 minutes): • *Discuss in groups the predictions made and observations noted during the simulation activities.* • *Reflect on how these observations align with theoretical knowledge.*
	Step 4 – **Real-life examples** ***(10 minutes):*** • *Discuss real-life examples where wind turbines are used, reinforcing theoretical concepts with practical applications.* *Examples:* ***Onshore Wind Turbines:*** *Whitelee Wind Farm in Scotland - Largest onshore wind farm in the UK and one of the largest in Europe. It features 215 turbines that generate enough electricity to power over 350,000 homes.* ***Offshore Wind Turbines:***

	• *Hornsea One Wind Farm in Yorkshire, UK – One of the world's largest offshore wind farm. It has 174 turbines generating up to 1.2 gigawatts (GW) of electricity, enough to power over one million homes. It is situated about 120 kilometres off the coast, making use of the strong and consistent winds in the North Sea.*
	Step 5 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about wind turbines.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Slides summarizing key points from the first session and introducing new activities and examples* • *SketchUp website for additional resources* • *Videos describing how Wind Turbines work*
EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** *How does engaging in Learning by Design activities contribute to your understanding of wind turbines?* 1. *It reinforces theoretical concepts through practical application.* 2. *It excludes the use of simulations, focusing solely on theoretical discussions.* 3. *It limits your exploration of wind turbine behaviour.* ***Feedback*** 1. *Correct. Engaging in Learning by Design activities allows you to apply theoretical knowledge practically, enhancing your understanding of wind turbine behaviour. This is because...* 2. *Incorrect. Learning by Design activities involve practical application through simulations, not excluding them for theoretical discussions alone. This is because...* 3. *Incorrect. Learning by Design activities encourage exploration and application of wind turbine behaviour through simulations. This is because...* ***Question 2*** *Why is it important for us to discuss real-life examples of wind turbines?* 1. *To relate theoretical knowledge to practical applications.* 2. *To avoid engaging in practical activities.* 3. *To limit our understanding of wind turbines.* ***Feedback*** 1. *Correct. Discussing real-life examples helps us relate theoretical knowledge to practical applications, reinforcing our understanding of wind turbines. This is because...* 2. *Incorrect. Discussing real-life examples enhances understanding by bridging theoretical knowledge with practical applications, rather than avoiding practical activities. This is because...* 3. *Incorrect. Discussing real-life examples expands understanding of wind turbines, rather than limiting it. This is because...*

	Question 3 *What role do group discussions play in our learning about wind turbines?* *1. They hinder reflection on simulation results.* *2. They encourage collaboration and deeper understanding.* *3. They limit interaction with SketchUp.* ***Feedback*** *1. Incorrect. Group discussions actually encourage reflection on simulation results, fostering deeper understanding.* *2. Correct. Group discussions promote collaboration and deeper understanding of wind turbines by sharing insights and reflections on simulation activities.* *3. Incorrect. Group discussions complement interaction with SketchUp by providing opportunities for reflection and collaborative learning.*

4.4. Module no 4: Earthquake Resistant Buildings

MODULE TITLE	*Comprehending the Building Resistance to Earthquakes*
MODULE GOAL(S)	*The module aims to equip learners with skills and knowledge related to understanding the basic principles of building construction regarding earthquake resistance. Learners will gain a deeper understanding of the basic building elements and properties which influence their resistance to earthquakes and how buildings react to diverse types of earthquakes. They will learn a simple and basic formula to calculate building resistance under earthquake situations. They will learn to adapt their theoretical knowledge to practical applications by analysing different situations of earthquakes and building reactions. They will transform their knowledge into daily life practices by designing buildings under given boundary conditions. The module will help learners acquire the competencies necessary to contribute to designing and evaluating simple earthquake-resistant buildings.*
LEARNING AUDIENCE	• *Educators and teachers responsible for instructing gifted students aged 12-15 years old.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: • *Explain basic building elements and construction structures;* • *Explain the factors that influence the building strength and building resistance to earthquakes;* • *Comprehend a basic and simple formula which is used to estimate building resistance;* • *Apply a basic and simple formula which to calculate building reactions under diverse earthquake conditions;* • *Design earthquake-resistant buildings using the simple formula and digital applications.*

LEARNING METHODS	*The main learning method will be "learning by design" which engages four steps.* • ***Situate Practice**: Learners will explore diverse types of building constructions, earthquake types, and building reactions without taking any instruction. In this phase, learners will use the Augmented Reality (AR) tool to situate the experience environment.* • ***Overt Instruction:** In this phase, learners will watch an instruction video shown by the AR tool. Learners will be explicitly informed about the basic principles of building elements that affect building resistance to earthquakes. They will be introduced to a basic simple formula to calculate building resistance to earthquakes.* • ***Critical Framing**: Learners will be given different building types and earthquake conditions within the AR tool. They will use the knowledge that they comprehended in the previous steps to analyse and evaluate resistance of buildings in given conditions.* • ***Transformed Practice:** Learners will be given with a scenario based on the real life situations. They are expected to design buildings which will be expected to resist earthquakes under given conditions. They will make decision for the best solution and design buildings using a digital design tool.* • ***Discussion and Presentation:** Learners will present their designs, and other students will discuss the solutions.*
DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing AR Tool (ZAPPAR) and digital design tool (SKETCHUP)* • *Projection equipment or screens for displaying the AR Case Study on Electrical Circuits.* • *Access to the AR Case Study 4 (Earthquake Resistant Buildings) developed earlier in the project for the theoretical introduction.* • *Access to the Toolkit Introduction videos* *Learning By Design and SketchUp Tool: https://www.youtube.com/watch?v=UzvBKjDxUJ4* *Tutorial for SketchUp Tool https://www.youtube.com/watch?v=rrKxqpSrRPY* • *Additional classroom materials such as pens, paper, and whiteboards for group discussions and activities.* • *SKETCHUP application to design buildings.*
CLASS SESSION 1	***Introduction to Series and Parallel Circuits***
CLASS SESSION GOAL(S)	*Class session 1 provides learners with a comprehensive understanding of building construction/design and earthquake resistance .Learners will gain insight into the fundamental concepts and principles of building elements, and their features. They will be taught a basic simple formula to calculate earthquake resistance of buildings. They will also become familiar with the practical uses of these circuits through simulations,*

	acquiring the knowledge and skills necessary to analyse and evaluate resistance of different building under different earthquake cases.
LEARNING OUTCOMES	*Upon completing the class session 1, the learners should be able to:* • *Recognize reactions of different buildings under different earthquake cases using ZAPPAR AR tools.* • *Explain basic building elements and construction structures;* • *Explain the factors that influence the building strength and building resistance to earthquakes;* • *Comprehend a basic and simple formula which is used to estimate building resistance;* • *Apply a basic and simple formula calculate building reactions under diverse earthquake conditions.*
LEARNING METHODS	*The main learning methods will be the first three "learning by design".* • ***Situate Practice**: Learners will explore diverse types of building constructions, earthquake types, and building reactions without taking any instruction. In this phase, learners will use the Augmented Reality (AR) tool to situate the experience environment.* • ***Overt Instruction:** In this phase, learners will watch an instruction video shown by the AR tool. Learners will be explicitly informed about the basic principles of building elements that affect building resistance to earthquakes. They will be introduced to a basic simple formula to calculate building resistance to earthquakes.* • ***Critical Framing**: Learners will be given different building types and earthquake conditions within the AR tool. They will use the knowledge that they comprehended in the previous steps to analyse and evaluate resistance of buildings in given conditions.*
SCENARIO FOR LEARING:	***Step 1 – Experiencing the Earthquakes with AR (15 minutes):*** • *Students will be given AR Case Study Flyers. In this step students will be given the first flyer and tablets.* • *Students will experience the AR content that includes 9 cases of earthquakes and buildings.* • *Students will discuss the given questions.*
	Step 2 – Watching instruction videos with AR (15 minutes): • ***Learning Video (10 minutes):*** 2. *Learners will be given second flyer of AR Cases.* 3. *Learners will access the instruction video and watch: https://www.youtube.com/watch?v=-UxyIhn0A5w&t=41s* 4. *Learners will take notes during the video instruction.*
	Step 3 – Analysing and Evaluating (10 minutes): • *Learners will be given AR Case Flyer 3.* • *Learners will analyse and evaluate given 3 cases of earthquakes and buildings. They will calculate building resistance and strength of building elements using the information and basic formula given in the second step.* • *Students will share their solutions with each other.*

	Step 4 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about earthquake resistant buildings..* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Earthquake Resistant Buildings (Pages 1, 2, 3)* • *Toolkit Introduction Videos ("Learning by Design and the SKETCHUP Tool", "Tutorial for SKETCHUP Tool")* • *SKETCHUP digital design tool website for additional resources*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *According to your experience from the animations, what do you think are the factors affecting the earthquake resistance of buildings? Write it down.* ***Question 2*** *Why are AR tools effective for learning about factors that influence the resistance of buildings against earthquakes?*
CLASS SESSION 2	***DESIGNING EARTHQUAKE RESISTANT BUILDINGS***
CLASS SESSION GOAL(S)	*Class session 2 aims to support learner transform their knowledge into practical applications. In this aim, they will be given a scenario in which they will design earthquake resistant building using SKETCHUP digital design tool.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Estimate the best design options by doing calculations.* • *Design earthquake-resistant buildings using the simple formula and digital applications.*
LEARNING METHODS	• ***Transformed Practice:*** *Learners will be given with a scenario based on the real life situations. They are expected to design buildings which will be expected to resist earthquakes under given conditions. They will make decision for the best solution and design buildings using a digital design tool. They will create designs individually.* • ***Discussion and Presentation:*** *Students will present their building designs. Group discussion will be done to evaluate effectiveness of designs.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (5 minutes):*** • *Learners are given the 4th Flyer of AR Case Study 4. The teacher briefly explains the scenario and asked question.*
	Step 2 – Creating the best scenario (10 minutes): • *Learners individually work and calculate the best option (best profit) for designing buildings. Learners decide the best for their own.*
	Step 3 – Designing (15 minutes): • *Learners log in to the SKETCUP design tool.* • *Learners design buildings according to the calculations made in the previous step.* • *Learners take a screenshot or save their designs for presentations.*

<table>
<tr><td></td><td>Step 4 – (Presentation and Discussion (10 minutes):
Learners present and claim their designs and calculations.
Other learners give feedback and comments to designs.</td></tr>
<tr><td>REFERENCE MATERIALS / BACKGROUND CONTENTS</td><td>FLYER 4 of AR Case Study
Pen and paper
SKETCHUP digital design tool.</td></tr>
<tr><td>EVALUATION OF THE CLASS SESSION 2 / ASSESMENT</td><td>Question
You're a contractor. That is, you are a person who builds and sells houses. When you build a house, you build and sell houses within the framework of certain legal responsibilities and conditions. You also need to make a profit.
You have a 200 m2 plot of land. You will build an apartment building on this land and sell the houses on it. The conditions are as follows when building a house on this land.
Your total budget to build the houses: 1.200.000 EU
3 types of houses can be built to fill this land. You can build houses of 80 m2, 100 m2 and 120 m2. You will build an apartment building with one flat (house) on each floor. The cost and material information you need to consider while building the houses are given in the tables below.
Table 1: Apartment costs and selling price of 1 apartment flat
<table>
<tr><th>Apartment</th><th>1 Column Cost</th><th>1 Floor Cost</th><th>Roof Cost</th><th>1 Apartment Flat Sale Price</th></tr>
<tr><td>80 m²</td><td>20.000 EU</td><td>80.000 EU</td><td>40.000 EU</td><td>120.000 EU</td></tr>
<tr><td>100 m²</td><td>20.000 EU</td><td>100.000 EU</td><td>50.000 EU</td><td>150.000 EU</td></tr>
<tr><td>120 m²</td><td>20.000 EU</td><td>120.000 EU</td><td>60.000 EU</td><td>180.000 EU</td></tr>
</table>
Table 2: Material weight and column strength information to be used in the apartment
<table>
<tr><th>Apartment</th><th>1 Column Cost</th><th>1 Floor Cost</th><th>Roof Cost</th><th>1 Apartment Flat Sale Price</th></tr>
<tr><td>80 m²</td><td>20.000 EU</td><td>80.000 EU</td><td>40.000 EU</td><td>120.000 EU</td></tr>
<tr><td>100 m²</td><td>20.000 EU</td><td>100.000 EU</td><td>50.000 EU</td><td>150.000 EU</td></tr>
<tr><td>120 m²</td><td>20.000 EU</td><td>120.000 EU</td><td>60.000 EU</td><td>180.000 EU</td></tr>
</table>
The apartment buildings you will build must be resistant to an earthquake of at least 9 NW.
Under these conditions, calculate the most profitable situation and draw the houses you will design in the SKETCHUP application. Then you will share the house you have drawn and how much profit you will make together with the calculation.</td></tr>
</table>

4.5. Module no 5: Three-dimensional Geometry

MODULE TITLE	*Three-dimensional Geometry*

MODULE GOAL(S)	*The module aims to equip students with skills and knowledge related to three-dimensional geometry. Students will gain a thorough understanding of the fundamental concepts of volume, surface area and the properties of three-dimensional shapes. They will learn to apply theoretical knowledge to practical applications through the construction and analysis of 3D models. The module will help students acquire the skills necessary to contribute to the design and evaluation of effective spatial configurations.*
LEARNING AUDIENCE	• *Educators and teachers responsible for instructing students aged 8-11 years old.*
LEARNING OUTCOMES	*On completion of the module, students should be able to:* • *Explain the concepts of volume and surface area in three-dimensional shapes.* • *Construct three-dimensional models of basic geometric shapes using simulations and physical materials.* • *Analyse and compare the properties of different three-dimensional shapes.* • *Apply concepts of three-dimensional geometry to real-world problems.*
LEARNING METHODS	• ***Direct Instruction**: Use of case studies and simulations to introduce three-dimensional geometry concepts.* • ***Interactive Simulations:** Use of simulations to allow students to construct and manipulate three-dimensional models.* • ***Design-Based Learning**: Engaging students in the design and construction of 3D models through guided activities and experimentation.* • ***Video-Based Learning**: Use of educational videos (Geogebra tool) to demonstrate practical applications and tips for using simulation tools effectively.* • ***Discussion and Reflection**: Facilitate group discussions to analyse predictions and observations made during simulation activities.*
DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access to access simulations.* • *Projection equipment or screens to show case studies and simulations.* • *Model building materials such as paper, scissors, tape and glue.* • *Access to educational videos on three-dimensional geometry and simulations.*
CLASS SESSION 1	***Introduction to Three-dimensional Geometry***
CLASS SESSION GOAL(S)	*To provide students with a comprehensive understanding of the concepts of volume and surface area in three-dimensional shapes. To familiarise students with the practical use of these concepts through simulations and model building.*
LEARNING OUTCOMES	*Upon completing the class session 1, the learners should be able to:*

	• *Understand the fundamental concepts of volume and surface area.* • *Explain how the volume and surface area of three-dimensional shapes are calculated using case studies and simulations.* • *Construct three-dimensional models of basic geometric shapes.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study to introduce concepts of volume and surface area.* • ***Interactive Simulations:*** *Use of simulations to allow students to build and manipulate three-dimensional models.* • ***Video-Based Learning:*** *Use of educational videos to demonstrate practical applications and tips for using simulation tools effectively.* • ***Discussion and Reflection:*** *Facilitating group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (10 minutes):*** • *Use of the AR Case Study based on Geogebra to introduce the concepts of volume and surface area.* • *Emphasise the importance of these concepts in three-dimensional geometry.*
	Step 2 – Simulations of three-dimensional models (30 minutes): • ***Learning Video (10 minutes):*** 1. *Watch introductory videos on how to use simulations to learn about 3D geometry: ("Learning by Design and the Geogebra tool" and "Tutorial for Geogebra").* • ***Quests-Tasks (20 minutes):*** 1. *Access simulations on a computer or tablet.* 2. *Build three-dimensional models of geometric figures within the simulation environment.* 3. *Compare the properties of these figures in terms of volume and surface area.*
	Step 3 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about three-dimensional geometry.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case study on three-dimensional geometry.* • *Educational videos on simulation tools and three-dimensional geometry.* • *Interactive simulations website for additional resources.*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *What is the main difference between volume and surface area in three-dimensional shapes?* *A) Volume measures the amount of space an object occupies, while surface area measures the size of the object's outer faces.*

	B) Volume refers only to the base of a three-dimensional object, while surface area refers only to the height of the object. *C) Volume is measured in linear units, while surface area is measured in cubic units.* *D) Volume and surface area are always equal for any three-dimensional shape.* ***Feedback*** *A) Correct* *B) Incorrect* *C) Incorrect* *D) Incorrect* ***Question 2*** *Why are simulations effective for learning about three-dimensional geometry?* *A) They allow us to observe how shadows of 3D objects are formed.* *B) They provide interactive virtual environments to simulate the behaviour of 3D models.* *C) They help memorise geometric formulae more quickly.* *D) They reduce the need to study basic geometry..* ***Feedback*** *A) Incorrect* *B) Correct* *C) Incorrect* *D) Incorrect* ***Question 3*** *What is the main advantage of using case studies in learning three-dimensional geometry?* *A) They allow practice in solving complex equations repetitively.* *B) They help to remember exact geometric definitions.* *C) They provide visual and interactive explanations of concepts, enhancing understanding through interaction with augmented reality.* *D) They ensure that students only focus on theory without practical applications.* ***Feedback*** *A) Incorrect* *B) Incorrect* *C) Correct* *D) Incorrect*
CLASS SESSION 2	***Engaging in Learning by Design Activities***

CLASS SESSION GOAL(S)	*To equip students with skills and knowledge related to the design and analysis of three-dimensional models. Students will gain a deeper understanding of the concepts of volume and surface area through hands-on design activities and simulations. They will learn to apply their theoretical knowledge to predict the impact of changes in spatial configurations and relate their learning to real-world applications.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Construct three-dimensional models using simulations.* • *Compare the properties of different three-dimensional shapes in terms of volume and surface area.* • *Apply three-dimensional geometry concepts to real-world problems.*
LEARNING METHODS	• ***Interactive Simulations:*** *Continue to use simulations to allow students to explore and refine their understanding of the behaviour of 3D models through hands-on experimentation**.*** • ***Design-Based Learning:*** *Engage students in the design and construction of 3D models through guided activities and experimentation.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during simulation activities.*
SCENARIO FOR LEARING:	***Step 1 – Recap the Key Points (5 minutes):*** • *Briefly review the key points learned in the previous class session.* • *If necessary, see again the Toolkit Introduction Videos (Geogebra)*
	Step 2 – Learning Activities (20 minutes): • *Participate in design-based learning activities where students will design and build three-dimensional models using simulations.* • *students can be grouped together to help one another*
	Step 3 – Reflection (5 minutes): • *Discuss in groups the predictions and observations noted during the simulation activities.* • *Reflect on how these observations align with theoretical knowledge.*
	Step 4* – Real-life examples *(10 minutes): • Discuss real-world examples where three-dimensional models are used, reinforcing theoretical concepts with practical applications. *Examples:* ***Architecture and Construction:*** • *Building Design: Architects use 3D models to design buildings, evaluate their structure and aesthetics, and perform simulations of how they will look once built.* ***Medicine:*** • *Prostheses and Orthoses: Customised 3D models are designed and manufactured to create prostheses and orthoses that perfectly fit patients' needs.* ***Engineering:***

	• *Product Design: Engineers use 3D modelling software to design and prototype products, from automobiles to electronic devices.*
	Step 5 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about three-dimensional geometry.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Slides summarising the key points of the first session and presenting new activities and examples.* • *Interactive simulations website for additional resources.* • *Real-world examples of three-dimensional models.*
EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** *How do the Design-Based Learning activities contribute to your understanding of three-dimensional geometry?* *A) They allow you to avoid common errors in geometric calculations.* *B) They reinforce theoretical concepts through practical application.* *C) They facilitate the memorisation of geometric formulae.* *D) They simplify the complexity of three-dimensional models by reducing them to two dimensions.* ***Feedback*** *A) Incorrect* *B) Correct* *C) Incorrect* *D) Incorrect* ***Question 2*** *Why is it important to discuss real-world examples of three-dimensional models?* *A) To improve the accuracy of theoretical calculations.* *B) To relate theoretical knowledge to practical applications.* *C) To focus only on abstract mathematical properties.* *D) To avoid the use of technology in learning.* ***Feedback*** *A) Incorrect* *B) Correct* *C) Incorrect* *D) Incorrect* ***Question 3*** *What role do group discussions play in our learning about three-dimensional geometry?* *A) They allow each student to work independently without distraction.* *B) They encourage collaboration and deeper understanding.*

	C) They ensure that all students reach the same conclusions without questioning. *D) They prevent the exploration of different perspectives and solution methods.* ***Feedback*** *A. Incorrect* *B. Correct* *C. Incorrect* *D. Incorrect*

4.6. Module no 6: Exploring Geometric Shapes and Measurement

MODULE TITLE	*Understanding Geometric Shapes and Measurement through AR and Simulations*
MODULE GOAL(S)	*This module aims to equip learners with skills and knowledge related to understanding geometric shapes and measurement in Math. Learners will gain a deeper understanding of two-dimensional geometric shapes and the concepts of area and perimeter and how to creatively integrate this knowledge through technology-enhanced learning tools. The module will help learners integrate theoretical mathematics with interactive technological tools to enhance their problem-solving abilities and computational thinking.*
LEARNING AUDIENCE	● *Educators and teachers are responsible for instructing students aged 8-11 years.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: ● *Explain the properties of two-dimensional geometric shapes, including their surfaces, angles, and boundary lines.* ● *Define area as the space inside a boundary and perimeter as the distance around it.* ● *Calculate the area and perimeter of 2D shapes.* ● *Use interactive technological tools to explore and visualise geometric concepts.*
LEARNING METHODS	● ***Direct Instruction:*** *Use the AR Case Study 6 (AR Math Adventure: Exploring Geometric Shapes and Measurement) to introduce concepts of two-dimensional geometric shapes and area and perimeter.* ● ***Interactive Simulations:*** *Use a QR code to allow learners to simulate and learn the relationship between a square and an isosceles right triangle.* ● ***Learning by Design:*** *Engage learners in designing and constructing a fictional game with imaginary characters and obstacles to explore the concepts of area and perimeter, using mathematical knowledge and problem-solving skills.*

	• ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and Sprite Lab tool" and "Tutorial for Sprite Lab Tool") to demonstrate practical applications and tips for using Sprite Lab simulations effectively.* • ***Discussion and Reflection:*** *Facilitate group discussions to analyse the predictions and observations made during the creations.*
DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing simulations.* • *Projection equipment or screens for displaying the AR Case Study on Geometric Shapes and Measurement.* • *Access to the AR Case Study 6 (Math Adventure: Exploring Geometric Shapes and Measurement).* • *Access to Spritelab (https://code.org/educate/spritelab/) and to instructional videos.*
CLASS SESSION 1	***Introduction to Geometric Shapes and Measurement***
CLASS SESSION GOAL(S)	*Class session 1 gives learners a brief understanding of geometric shapes and measurement. Learners will gain insight into two-dimensional geometric shapes and the concepts of area and perimeter. They will also become familiar with calculating the area and perimeter of 2D shapes.*
LEARNING OUTCOMES	*Upon completing the class session 1, the learners should be able to:* • *Recognise examples of 2D shapes.* • *Understand the fundamental concepts of area and perimeter.* • *Explain how the area and perimeter of two-dimensional shapes are calculated using case studies and simulations.* • *Understand the relationship between a square and an isosceles right triangle.*
LEARNING METHODS	• ***Direct Instruction:*** *Use the AR Case Study to introduce concepts of geometric shapes and their surfaces, angles, and boundary lines.* • ***Interactive Simulations:*** *Use simulations to help learners calculate the area and perimeter of 2D shapes.* • ***Discussion and Reflection:*** *Facilitate group discussions based on students' observations.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (15 minutes):*** • *Use the AR Case Study on geometric shapes and their surfaces, angles, and boundary lines.* • *Give examples of 2D shapes and ask the students to find these shapes in their everyday lives.* • *Let the students observe how many surfaces, angles, and boundary lines have each 2D shape.* • *Introduce the concepts of the area and perimeter of 2D shapes and how to calculate them.*
	Step 2 – Educational exercises (20 minutes): • *Let students scan the code to learn the relationship between a square and an isosceles right triangle.*

	• *Discuss how two isosceles and right triangles can form a square when combined, illustrating the geometric relationship and properties.* • *Let students scan the code of the AR-based quiz to test their knowledge of square measurements.*
	Step 3 – Wrap-Up and Discussion (10 minutes): • *Recap the key points learned about geometric shapes and measurement.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Geometric shapes and measurement (Pages 1, 2, 3)* • *Toolkit Introduction Videos ("Learning by Design and Sprite Lab tool" and "Tutorial for Sprite Lab Tool")*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** ***Which of the following is an example of a two-dimensional geometric shape?*** 1. *Sphere* 2. *Square* 3. *Cube* ***Feedback*** 1. *Incorrect. A sphere is three-dimensional because it has volume and extends in all directions from its centre.* 2. *Correct. A square is a two-dimensional shape because it only has length and width, lying flat on a plane without depth.* 3. *Incorrect. A cube is a three-dimensional shape with depth.* ***Question 2*** ***What is the difference between area and perimeter for 2D shapes?*** 1. *Area measures the distance around the shape, while perimeter measures the space inside the shape.* 2. *Area and perimeter both measure the space inside the shape.* 3. *Area measures the space inside the shape, while perimeter measures the distance around the shape.* ***Feedback*** 1. *Incorrect. This choice reverses the definitions of area and perimeter.* 2. *Incorrect. Area and perimeter measure different aspects of a shape: area measures the internal space, while perimeter measures the boundary length.* 3. *Correct. Area refers to the space contained within the boundaries of a shape, while perimeter refers to the total distance around the outside of the shape.* ***Question 3***

	How do you calculate the area and perimeter of a square with a side length of 6 units? 1. *Area = 12 square units, Perimeter = 18 units* 2. *Area = 36 square units, Perimeter = 24 units* 3. *Area = 24 square units, Perimeter = 36 units* ***Feedback*** 1. *Incorrect. This calculation does not use the correct formulas for area and perimeter of a square. Area should be (side) × (side) and perimeter should be 4 × side.* 2. *Correct. The area of a square with a side length of 6 units is calculated as (6 × 6) = 36 square units, and the perimeter is calculated as (4 × 6) = 24 units.* 3. *Incorrect. This reverses the correct calculations for area and perimeter.*
CLASS SESSION 2	***Engaging in Learning by Design Activities***
CLASS SESSION GOAL(S)	*Class Session 2 aims to equip learners with skills and knowledge related to designing two-dimensional models. Students will gain a deeper understanding of geometric shapes, their surfaces, angles, and boundary lines, as well as the concepts of area and perimeter through hands-on design activities and simulations. They will learn to apply their theoretical knowledge effectively.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* ● *Construct fictional game with imaginary characters and obstacles to navigate the concepts of area and perimeter.* ● *Compare the properties of different two-dimensional shapes in terms of area and perimeter.* ● *Learn how to use Sprite Lab tool.*
LEARNING METHODS	● ***Video-Based Learning:*** *Use of educational videos to demonstrate practical applications and tips for using tools effectively.* ● ***SpriteLab tool:*** *Use the tool to enable students to design a game that strategically incorporates the concepts of area and perimeter in relation to 2D shapes.* ● ***Discussion and Reflection:*** *Facilitate group discussions to analyse predictions and observations made during activities.*
SCENARIO FOR LEARING:	***Step 1 – Recap the Key Points (5 minutes):*** ● *Briefly review the key points learned in the previous class session.*
	Step 2 – Learning Activities (30 minutes): ● *Students can be grouped to help each other.* ● *Engage in Learning by Design activities where learners will design a game that strategically incorporates the concepts of area and perimeter about 2D shapes using the Sprite Lab tool.*
	Step 3 – Presentation and discussion (10 minutes): ● *Each team picks one person to represent their game in front of the class.* ● *Encourage students to reflect on what they have learned and summarise the lessons.*

REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Slides summarising key points from the first session.* • *Toolkit Introduction Videos ("Learning by Design and Sprite Lab tool" and "Tutorial for Sprite Lab Tool")* • *Sprite Lab tool.*
EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** ***How do the Design-Based Learning activities contribute to your understanding of 2-dimensional geometry?*** 1. *They allow you to apply geometric concepts in creative and practical ways.* 2. *They help you memorise formulas for area and perimeter.* 3. *They focus on competitive gaming skills.* ***Feedback:*** 1. *Correct. Design-based learning activities encourage students to use their knowledge of 2-dimensional geometry to create and explore, enhancing understanding through hands-on application.* 2. *Incorrect. While memorisation can be part of learning, Design-Based Learning focuses more on application and understanding than rote memorisation.* 3. *Incorrect. The emphasis is on learning and applying geometry concepts, not on competition.* ***Question 2*** ***How does working in teams enhance your learning experience in Design-Based Learning activities?*** 1. *It allows you to delegate all tasks to others.* 2. *It fosters collaboration and idea-sharing to solve complex problems.* 3. *It ensures that only one person's ideas are used.* ***Feedback:*** 1. *Incorrect. Teamwork is about collaboration and shared effort, not simply passing tasks to others.* 2. *Correct. Working in teams encourages students to combine their strengths and perspectives, leading to more effective problem-solving and a deeper understanding of concepts.* 3. *Incorrect. Effective teamwork involves considering multiple viewpoints and integrating diverse ideas for the best outcomes.* ***Question 3*** ***What role do group discussions play in learning about geometric shapes and measurement?*** 1. *They allow you to listen passively without contributing.* 2. *They are used to present memorized definitions without further exploration.* 3. *They provide opportunities to clarify misunderstandings and deepen understanding through peer explanations.* ***Feedback:*** 1. *Incorrect. Effective group discussions require active participation and sharing of ideas.*

	2. *Incorrect. Discussions should go beyond memorisation, encouraging exploration and application of concepts.* 3. *Correct. Group discussions encourage students to articulate their understanding, ask questions, and learn from each other, enhancing comprehension of geometric shapes and measurement.*

4.7. Module no 7: Virtual Art Gallery

MODULE TITLE	*Exploring Art through Virtual Galleries and Digital Tools*
MODULE GOAL(S)	*The module aims to equip learners with skills and knowledge related to designing and implementing engaging virtual art gallery projects. Learners will gain a deeper understanding of how virtual art galleries can enhance student learning and engagement by integrating arts and technology. They will learn how to adapt to using Tinkercad for creative STEAM education, effectively combining digital tools with artistic expression. The module will help learners acquire the competencies necessary to contribute to innovative educational practices, fostering creativity and technical proficiency in the classroom.*
LEARNING AUDIENCE	• *Educators and teachers responsible for instructing students aged 12-15 years old.*
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: • *Confidently use Tinkercad to create digital art, 3D models, and virtual gallery experiences.* • *Design a virtual art gallery layout and curate a collection of student-created artwork.* • *Develop lesson plans that integrate virtual art gallery creation into their existing curriculum.* • *Assess student learning and engagement in virtual art gallery projects.*
LEARNING METHODS	• ***Direct Instruction:*** *Use of the AR Case Study 7 (Virtual Art Exhibition Event) to introduce concept of the virtual art and art exhibition.* • ***Interactive Design:*** *Use Tinkercad to allow learners to design and curate virtual art galleries.* • ***Learning by Design:*** *Engage learners in creating digital art pieces and gallery layouts through guided activities and creative exploration.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and the Tinkercad Tool" and "Tutorial for Tinkercad Tool") to provide practical guidance on using Tinkercad tool in creating art.* • ***Discussion and Reflection:*** *Facilitate group discussions to explore the potential of virtual galleries in art education and student engagement.*

DURATION:	*Two (2) class periods (45 minutes each)*
TOOLS NEEDED:	• *Computers or tablets with internet access for accessing Tinkercad simulations.* • *Projection equipment or screens for displaying the AR Case Study on Virtual Art Exhibition Event.* • *Access to the AR Case Study 7 (Virtual Art Exhibition Event) developed earlier in the project for theoretical introduction.* • *Access to the Toolkit Introduction videos ("Learning by Design and the Tinkercad Tool" and "Tutorial for Tinkercad Tool").* • *Additional classroom materials such as colourful pens, paper, and whiteboards for group discussions and activities.*
CLASS SESSION 1	***Introduction to Virtual Art Galleries with Tinkercad***
CLASS SESSION GOAL(S)	*Class session 1 provides learners with a comprehensive understanding of how to use Tinkercad to create virtual art galleries. Learners will gain insight into the fundamental concepts and tools within Tinkercad that allow them to design virtual art spaces and curate collections of artwork.*
LEARNING OUTCOMES	*Upon completing class session 1, the learners should be able to:* • *Understand the basic features of Tinkercad for creating digital art and galleries.* • *Design a simple virtual gallery layout using Tinkercad.* • *Curate a collection of student-created artwork within a virtual gallery.*
LEARNING METHODS	• ***Direct Instruction:*** *Introduce Tinkercad and its features for virtual gallery creation.* • ***Interactive Design:*** *Use Tinkercad to design virtual gallery spaces and curate collections.* • ***Video-Based Learning:*** *Use instructional videos ("Learning by Design and the Tinkercad Tool" and "Tutorial for Tinkercad Tool") to provide practical guidance on using Tinkercad tool in creating art.* • ***Discussion and Reflection:*** *Facilitate group discussions to explore the potential of virtual galleries in art education.*
SCENARIO FOR LEARING:	***Step 1 – Introduction (10 minutes):*** • *Use the AR Case Study on Virtual Art Exhibition Event to introduce the concept of the virtual art and art exhibitions.* • *Discuss the educational benefits of virtual galleries.*
	Step 2 – Creating Virtual Art with Tinkercad (30 minutes): • ***Learning Video (10 minutes):*** 1. *Watch the Introduction videos ("Learning by Design and the Tinkercad Tool" and "Tutorial for Tinkercad Tool") to understand its features.* • ***Quests-Tasks (20 minutes):*** 1. *Access Tinkercad simulations on a computer or tablet.*

	2. *Use Tinkercad to create a simple virtual gallery space.* 3. *Experiment with different design elements to curate a collection of artwork.*
	Step 3 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about Tinkercad and virtual art galleries.* • *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *AR Case Study on Virtual Art Exhibition Event (Pages 1, 2, 3)* • *Toolkit Introduction Videos ("Learning by Design and the Tinkercad Tool" and "Tutorial for Tinkercad Tool")* • *Tinkercad website for design resources*
EVALUATION OF THE CLASS SESSION 1 / ASSESMENT	***Question 1*** *What is a primary benefit of using Tinkercad for creating virtual art galleries?* 1. *It allows for interactive and creative design of digital art spaces.* 2. *It focuses only on traditional art methods.* 3. *It limits student interaction with digital tools.* ***Feedback*** 1. *Correct. Tinkercad allows for interactive and creative design of digital art spaces, enhancing student engagement and creativity.* 2. *Incorrect. Tinkercad enhances interaction by providing a digital platform for creative expression, not focusing solely on traditional methods.* 3. *Incorrect. Tinkercad enhances interaction and creativity through digital tools.* ***Question 2*** *How can Tinkercad be used effectively in art education?* 1. *By focusing solely on physical art creation.* 2. *By providing a platform for students to create and curate digital art collections.* 3. *By limiting access to digital tools.* ***Feedback*** 1. *Incorrect. Tinkercad focuses on digital art creation, not solely on physical art methods.* 2. *Correct. Tinkercad provides a platform for students to create and curate digital art collections, integrating technology with art education.* 3. *Incorrect. Tinkercad enhances access to digital tools for creative exploration.* ***Question 3*** *Which feature of Tinkercad makes it suitable for educational purposes?* 1. *Its ability to create physical sculptures.*

	2. *Its user-friendly interface and accessibility for digital design.* 3. *Its focus on limiting digital interaction.* ***Feedback*** 1. *Incorrect. Tinkercad is focused on digital design rather than physical sculpture creation.* 2. *Correct. Tinkercad's user-friendly interface and accessibility make it suitable for educational purposes.* 3. *Incorrect. Tinkercad enhances digital interaction, not limits it.*
CLASS SESSION 2	***Designing and Curating Digital Art with Tinkercad***
CLASS SESSION GOAL(S)	*Class session 2 aims to equip learners with the skills and knowledge needed to design and curate digital art within virtual galleries using Tinkercad. Learners will gain a deeper understanding of virtual gallery spaces through hands-on design activities and digital tools. They will learn how to apply their creative and technical skills to create engaging virtual art environments and relate their learning to educational contexts.*
LEARNING OUTCOMES	*Upon completing the class session 2, the learners should be able to:* • *Design and curate a virtual art gallery using Tinkercad.* • *Collaborate with peers to develop creative digital art projects.* • *Reflect on potential impact of virtual art galleries in education.*
LEARNING METHODS	• ***Interactive Design****: Continue using Tinkercad to explore and refine virtual gallery designs through creative experimentation.* • ***Learning by Design****: Engage learners in designing and curating virtual art galleries through guided activities.* • ***Discussion and Reflection****: Facilitate group discussions to analyze the impact of digital tools on art education and student creativity.*
SCENARIO FOR LEARING:	***Step 1 – Recap the Key Points (5 minutes):*** • *Briefly review the key points learned in the previous class session.*
	Step 2 – Creative Activities (20 minutes): • *Engage in design activities where learners will design and curate virtual art galleries using Tinkercad.*
	Step 3 – Reflection (5 minutes): • *Discuss in groups the impact of digital tools on art education and creativity.* • *Reflect on how these tools can be integrated into the curriculum.*
	Step 4 – **Real-life applications** ***(10 minutes):*** • Discuss real-life applications of virtual art galleries in education and beyond. *Examples:* • ***Virtual Museum Tours:*** *Allowing students to explore famous art collections digitally.* • ***Student Exhibitions:*** *Creating virtual spaces to showcase student artwork.*
	Step 5 – Wrap-Up and Discussion (5 minutes): • *Recap the key points learned about virtual art galleries.*

	• *Encourage students to reflect on their learning experiences and ask questions.*
REFERENCE MATERIALS / BACKGROUND CONTENTS	• *Slides summarizing key points from the first session and introducing new activities and examples* • *Tinkercad website for additional design resources* • *Examples of virtual art galleries and their applications in education*
EVALUATION OF THE CLASS SESSION 2 / ASSESMENT	***Question 1*** *How does engaging in virtual art gallery design activities contribute to your understanding of art education?* 1. *It reinforces theoretical concepts through practical application.* 2. *It excludes the use of digital tools, focusing solely on traditional art methods.* 3. *It limits creativity by focusing on pre-made templates.* ***Feedback*** 1. *Correct. Engaging in virtual art gallery design activities allows you to apply creative and technical skills practically, enhancing your understanding of art education.* 2. *Incorrect. Virtual gallery design activities involve practical application through digital tools, not excluding them for traditional methods alone.* 3. *Incorrect. Tinkercad encourages creativity by allowing custom designs rather than limiting creativity.* ***Question 2*** *Why is it important to discuss real-life applications of virtual art galleries?* 1. *To relate theoretical knowledge to practical applications.* 2. *To avoid engaging in digital activities.* 3. *To focus only on traditional art exhibitions.* ***Feedback*** 1. *Correct. Discussing real-life applications helps relate theoretical knowledge to practical applications, reinforcing understanding of digital tools in art education.* 2. *Incorrect. Discussing real-life applications enhances understanding by bridging theoretical knowledge with practical applications, not avoiding digital activities.* 3. *Incorrect. The focus is on integrating digital tools, not solely traditional exhibitions.* ***Question 3*** *What role do group discussions play in learning about virtual art galleries?* 1. *They hinder reflection on creative processes.* 2. *They encourage collaboration and deeper understanding.* 3. *They limit the sharing of creative ideas.* ***Feedback***

	1. *Incorrect. Group discussions encourage reflection on creative processes, fostering deeper understanding.* 2. *Correct. Group discussions promote collaboration and deeper understanding of digital art and gallery design concepts by sharing insights and reflections on creative activities.* 3. *Incorrect. Group discussions enhance sharing and collaboration rather than limiting ideas.*

5. AR Tool: Zapworks Designer

One of the main AR tools that are proposed for creating lessons by teachers and then used by students to perform tasks required as part of the implementation of individual lessons is Zapworks Designer. Below we provide a brief description of this tool along with instructions for use.

Zapworks Designer

Zapworks Designer is a powerful, browser-based tool designed for creating Augmented Reality experiences without the need for coding expertise. The Giftled AR Case Studies offer immersive experiences designed to captivate and engage the students without the need for technical know-how.

Why Choose Zapworks Designer?

Zapworks Designer offers a user-friendly interface where no coding is required. It provides cross-platform accessibility, allowing users to access AR experiences from any web browser, ensuring flexibility and convenience. Furthermore, it facilitates engagement by offering storytelling, thereby making learning and discovery more captivating. Teachers and educators can also create their own AR case studies using the platform, which is accessible at www.zappar.com/. For assistance and guidance, they can find resources at https://docs.zap.works/.

Accessing AR Experiences:

Using the ZapWorks App: To explore our AR case studies, download the ZapWorks app from your app store (available on iOS and Android). Once the app has been installed, it is simply necessary to launch it and point the device's camera at the QR code provided with each case study. The digital content will then come to life.

QR Code Scanning: Alternatively, the QR codes associated with each AR case study can be scanned directly using the device's camera. This method allows for instant access to the augmented reality experience, eliminating the need for app downloads if preferred.

Annex 1. Guidelines for Curriculum Modules

The guidelines for preparing the modules are described are proposed as follows:

Module Goal(s) (50-60 words)

Write a brief summary of the Module focusing on what the learner will gain by taking this Module. Refer to the learner directly. Do not repeat the Learning Outcomes.

E.g.:

Module aims to equip learners with skills and knowledge related to ..... Learners will gain a deeper understanding of how ..... They will learn how to adapt to ..... Module will help learners acquire the competences necessary to contribute to .....

or

Module provides learners with a comprehensive understanding of ..... Learners will gain insight into the fundamental concepts and principles of ..... They will also become familiar with its practical uses in ..... Learners will acquire the knowledge and skills necessary to recognize how ..... works, its potential benefits, and its limitations.

Learning Audience (2-3 profiles)

Who's going to read this Module? Separate different audiences with commas.

E.g. Pupils, Youth workers, Young people, Teachers, NGO members, Elementary Students, Trainers, Youth Organizations

Learning Outcomes (3-4 Learning Outcomes)

Start with a verb. Use Bloom's Taxonomy and ABCD format to write the Learning Outcomes. It's better to focus on what the learners should know.

E.g. Upon completing the Module, the learners should be able to:

- *Apply this method*
- *Contrast this with that*
- *Give examples about that*
- *Define ..... / Describe ..... / Determine ....*
- *Recognize the importance of ....*
- *Identify ..... / Develop ....*

- *Examine .....*

Learning Methods (3-4 Methods)

What are the learning methods used to realise the learning outcomes of the Module? List the different methods used in the Module with bullet points and shortly describe if needed.

E.g. Learning by Design, Problem-based learning, Gamification, Scenario-based learning, Digital storytelling, Case studies, Group Discussions, Tutorials, Planned Reading, Web quests, Quizzes, Scientific research analysis

Duration

Specify how much time the pupils will need to accomplish all the activities defined in the module.

E.g. 60 minutes, 2 hours, 1 day, 1week, ….

Tools needed

What are the tools or materials needed to be used for the realization of the Module?

Refer to the materials produced early in WP2, i.e. augmented reality case studies and toolkit introduction videos. Also other additional tools or materials and be indicated here.

Scenario for learning (activities to fulfil all defined Learning Outcomes)

1. The content should present the scenario of the Module in the form of steps with learning activities to perform, such as learning presentation, learning video, learning case study, quests-task to realize, additional materials (i.e. scientific and popular science articles, technical documents, blogs).
2. The references of the Module have to be added at the end of the Content.
3. The content should adequately cover ALL learning outcomes. This is the must-know content. Do not overload the content with information that a learner MAY

find useful. This is the good-to-know content. Stick to must-know content as much as possible.

4. Provide learners with the specific steps required, highlighting processes of what they should do to perform a certain task.
5. Provide real-life examples that the learners can relate to.
6. Use markdown format to make everything easily readable and memorable. Use bold font to highlight critical information, as well as bulleted lists with related explanations, as much as possible.
7. Reflection questions within the content are always welcome, provided that they are relevant to the learners' everyday needs/practice.

Reference Materials / Background Contents

Propose the reference materials, publications, articles that can be useful to realize the Module both for the teacher and for the learner.

Evaluation of the Module / Assessment (1-2 M/C questions per Learning Outcome)

1. Align the quiz questions to the Learning Outcomes. Avoid asking questions that test their short-term memory (e.g. when did this happen, who did what, etc.)
2. Write enough questions to cover all the Learning Outcomes. Ensure every Learning Outcomes is addressed in at least one quiz question.
3. Choose multiple-choice questions with 3 or a maximum of 4 choices (2-3 distractors and one correct choice). Underline the correct answer.
4. Make sure that the answer to each question is not obvious by creating distractor choices that make sense.
5. Avoid creating lengthy question stems and choices (each choice should be less than 20 words).
6. Choices should be approximately of the same size and should not include "all of the above" or "none of the above" as options.
7. Provide feedback for correct and all incorrect choices. Just stating that an answer is correct or incorrect is not constructive.

E.g.

Question 1

Which of the following is a benefit of cause marketing for social enterprises?

1. *Increased product sales*
2. *Reduced operational costs*
3. *Enhanced brand perception*

Feedback

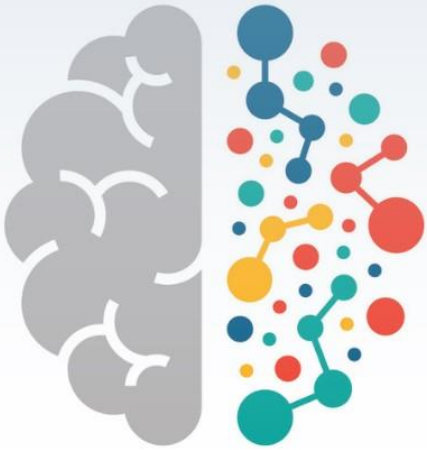
1. *Incorrect. While cause marketing may indirectly lead to increased product sales, it is not a direct benefit for social enterprises in the context of cause marketing. This is because….*
2. *Incorrect. Cause marketing does not directly contribute to reducing operational costs for social enterprises. This is because….*
3. *Correct. Enhanced brand perception is a significant benefit of cause marketing for social enterprises. Collaborating with for-profit companies can elevate the social image and credibility of the social enterprise within the community.*

Teachers are recommended to use the following template to create their own lesson module:

MODULE TITLE	**….**
MODULE GOAL(S)	**….**
LEARNING AUDIENCE	• •
LEARNING OUTCOMES	*Upon completing the Module, the learners should be able to*: • •
LEARNING METHODS	• •
DURATION:	**….**
TOOLS NEEDED:	• •
SCENARIO FOR LEARING:	**Step 1 –**
	Step 2 –
	Step 3 –
	Step 4 –
	Step 5 –

	Step 6 –
REFERENCE MATERIALS / BACKGROUND CONTENTS	**….**
EVALUATION OF THE MODULE / ASSESMENT	**….**

PROJECT N°:
2022-1-PL01-KA220-SCH-000087644



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