BE 21 SKILLED

Step-by-step guidance for HEI teachers and study program managers to implement hands-on, real-life, problem-based tools for their students

01	Self-management, purposefulness, perseverance
02	Critical thinking, problem-solving, systems thinking
03	Communication, collaboration, teamwork
04	Adaptability, resilience, and stress resistance
05	Creativity, curiosity, open mindset, spotting opportunities
06	Wellbeing, positive attitude, mindfulness
07	Emotional intelligence and empathy

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Funded by the European Union

www.**be21skilled**.eu

WELCOME - 21st Century Skills – Skills for the STEM Future of Europe and Beyond

In the rapidly changing domain of STEM, the demand for skills that would match the needs of modern society goes beyond traditional technical competencies, or hard skills. With the advent of automation, AI, ever upgraded algorithms and systematisation, hard skills are no longer crucial commodity.

What sets apart a worker of the future are skills that cannot be performed by AI? Here we refer to them as 21st century skill - high order skills that have been pinpointed as skills of future by many major bodies such as OECD, UNESCO, EU. These include emotional intelligence, resilience, positive attitude, mindfulness, self-management, etc. These skills are often not taught in schools and universities explicitly, rather some subjects may touch upon them implicitly.

This is the tradition that the BE-21-SKILLED project (Building an Ecosystem for 21st Century Skills Education in STEM) is trying to tear down. By creating tools that can be easily integrated into lesson plans, BE-21-SKILLED aims to systematically add 21st century skills on the radar of higher education institutions, in particular those in the STEM fields. The beauty of the tools is that they can be applied in other disciplines, thus replication potential is enormous.

The Toolkit heavily relies on extensive research carried out in the previous stages of the project. To access rich knowledge contained there please check our official website: **https://be21skilled.eu/**

We hope you enjoy using the abundance of tools that you are about to discover!

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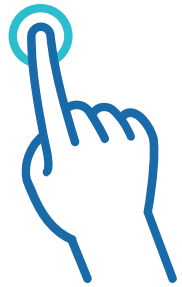


SELF-MANAGEMENT, PURPOSEFULNESS, PERSEVERANCE

01|SELF-MANAGEMENT, PURPOSEFULNESS, PERSEVERANCE

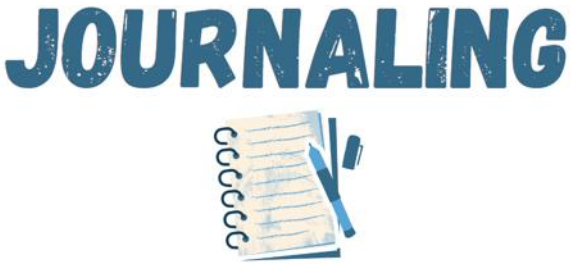
This cluster combines a range of interrelated skills and competencies that empower individuals to understand and control their capabilities and limitations, enhancing their ability to manage activities across various contexts.

As outlined by Līce, et al., (2023), it encompasses skills such as autonomy, self-efficacy, self-awareness, self-control, self-regulation, self-direction, goal achievement, goal orientation, decision-making, motivation, perseverance, planning management, project management, risk management, and resource management. Self-management skills require individuals to act consciously and responsibly, accept feedback, adapt to change, and seek opportunities for personal and professional growth. This alternatively comprises traits like self-discipline and a professional attitude.

Moreover, research points out the significance of purposefulness and perseverance. Purposefulness refers to “the quality of having a sense of direction and a strong motivation to achieve a specific outcome” (Līce, et al., 2023, p. 30). In contrast, perseverance highlights the capacity to store energy over the long term, conquer obstacles, and maintain a solid commitment to reaching goals (Griban et al., 2020, as cited in Līce et al., 2023).

These qualities, purposefulness and perseverance, work together to improve an individual's capacity to not only create goals, but to stick to them while overcoming obstacles along the way. In the dynamic world of STEM, where challenges are commonplace, the fusion of **self-management, purposefulness, and perseverance** is fundamental in ensuring personal growth and professional success.

TOOL DESCRIPTION + ITS RELEVANCE



"Journaling: Where your thoughts, dreams, and reflections come together, painting a picture of your journey."

Journaling is a reflective practice of writing down thoughts, feelings, experiences, and observations in a personal journal.

Its relevance in teaching **perseverance** lies in providing students with a means to self-reflect, set goals, track progress, and navigate challenges.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

Journaling can be integrated as a regular activity in STEM lessons or workshops where students encounter complex problem-solving, experiments, or projects. Students can be given some time at the beginning of some sessions so that they can journal about their previous achievements, challenges, and goals.

LEARNING OUTCOMES

By using Journaling, students will be able to:

- Cultivate a growth mindset by reflecting on challenges and setbacks.
- Develop self-awareness regarding their reactions and emotions during challenging situations.
- Set and adjust goals with a focus on persistence and long-term progress.
- Strengthen resilience by documenting strategies used to overcome obstacles.
- Enhance their ability to self-motivate and stay committed to their goals.

TEACHING METHODS USED

To implement Journaling effectively, the following teaching methods can be used:

- Guided prompts: Provide prompts that encourage students to reflect on challenges faced, lessons learned, and strategies employed to persevere.
- Self-reflection exercises: Encourage students to engage in self-reflective writing about their journey and experiences with perseverance.
- Peer sharing and discussions: Create opportunities for students to share selected journal entries with peers, fostering discussions about perseverance and strategies.

SPECIFIC RESOURCES/EQUIPMENT USED

- **Journals or digital platforms:** Provide physical notebooks or online platforms for students to maintain their journals.
- **Guiding prompts:** Prepare a list of prompts that guide students' reflections on perseverance.

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programs and at different semesters in their studies. Some of their specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of Journaling are:

- Provides a private space for students to express their thoughts, emotions, and challenges.
- Encourages introspection and self-awareness about the process of perseverance.
- Helps students track their progress and identify patterns in their persistence strategies.
- Encourages a positive attitude toward challenges and setbacks.

Disadvantages of Journaling are:

- Relies on students' willingness to engage openly and honestly in self-reflection.
- May require consistent practice over time to observe meaningful results.
- May not suit all learning preferences (e.g., some students may not enjoy writing).

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Journaling tool can be adapted to suit the specific needs and preferences of the students and teachers. Some possible variations include:

- **Visual journaling:** Encourage students to incorporate visual elements like diagrams, sketches, or mind maps into their journal entries.
- **Digital journaling:** Use online journaling platforms or apps to facilitate digital journaling, making it accessible and convenient.
- **Themed journals:** Offer specialized journals with prompts tailored to specific STEM disciplines.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the acquisition of perseverance through Journaling, the following assessment methods can be considered:

- **Periodic journal review:** Review selected journal entries to evaluate students' depth of reflection and understanding of perseverance.
- **Peer feedback:** Encourage students to provide feedback on each other's journal entries, fostering a supportive learning environment.
- **Reflection papers:** Ask students to write reflection papers summarizing their key insights and growth in terms of perseverance.

TOOL DESCRIPTION + ITS RELEVANCE

"A good tool improves the way you work. A great tool improves the way you think."
- Jeff Duntemann

The SMART goals tool is relevant to teaching **perseverance** as it provides a structured approach for students to set meaningful objectives, track progress, and maintain motivation in the face of challenges.

By using SMART goals, students can cultivate **perseverance** by breaking down their aspirations into actionable steps and maintaining focus on their desired outcomes.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

It can be integrated at the beginning of a course, semester, or personal development module to set clear objectives and guide students in managing their time and resources.

LEARNING OUTCOMES

By using Perseverance SMART Goals, students will be able to:

- Enhance their ability to set specific and meaningful goals.
- Improve their understanding of the importance of measuring progress and celebrating achievements.
- Strengthen their belief in their capacity to achieve goals through actionable steps.
- Increase resilience and perseverance in the face of challenges.

TEACHING METHODS USED

To implement the Perseverance SMART Goals tool effectively, the following teaching methods can be used:

- **Interactive discussions:** Engage students in discussions about the importance of perseverance in STEM fields. Encourage them to share personal experiences where perseverance led to success. Discuss the role of setbacks and failures in the learning process.
- **Feedback and support groups:** Form support groups where students share their goals and progress. Provide a platform for constructive feedback and advice on overcoming obstacles.

SPECIFIC RESOURCES/EQUIPMENT USED

- Writing materials, such as paper and pens/pencils, for students to document their goals and action plans.
- Whiteboards or posters to visually illustrate the SMART Goals components.

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programs and at different semesters in their studies.
Some of their specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Perseverance SMART Goals tool:

- Provides a structured approach to goal setting, enhancing clarity and focus.
- Encourages students to measure their progress and celebrate small victories.
- Fosters a growth mindset by promoting self-belief and the understanding that effort leads to achievement.
- Develops planning and time management skills necessary for goal attainment.

Disadvantages of the Perseverance SMART Goals tool:

- Overemphasis on achieving measurable outcomes, potentially neglecting other aspects of personal growth.
- Possibility of setting overly ambitious goals that can lead to discouragement if not achieved.
- Requires ongoing commitment and self-motivation from students.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Perseverance SMART Goals tool can be adapted to suit the specific needs and preferences of the students and teachers. Some possible variations include:

- Adding an extra component to SMART goals, such as an emotional or ethical aspect (e.g., SE-SMART goals: Specific, Emotionally Aligned, Measurable, Attainable, Relevant, and Time-bound).
- Incorporating visual aids or infographics to help students visualize their goals and action plans.
- Integrating technology by using goal-tracking apps (Asana) or digital platforms for collaborative goal setting and progress monitoring.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the acquisition of perseverance through SMART Goals, the following assessment methods can be considered:

- **Self-assessment:** Students can reflect on their goal-setting skills and progress.
- **Peer assessment:** Students can provide feedback on each other's goals and action plans.
- **Goal progress tracking:** Students can track their progress and present updates periodically.
- **Goal achievement evaluation:** Students can showcase the outcomes of their SMART goals and discuss the strategies used to overcome obstacles.

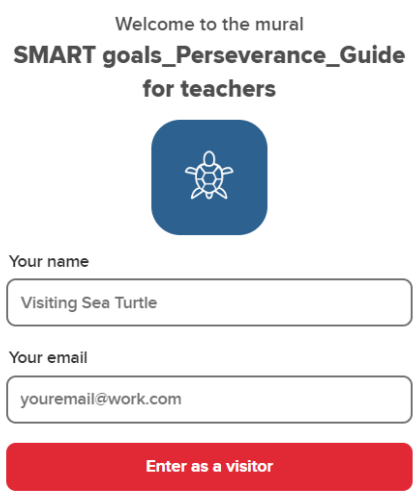
GUIDE FOR EDUCATORS

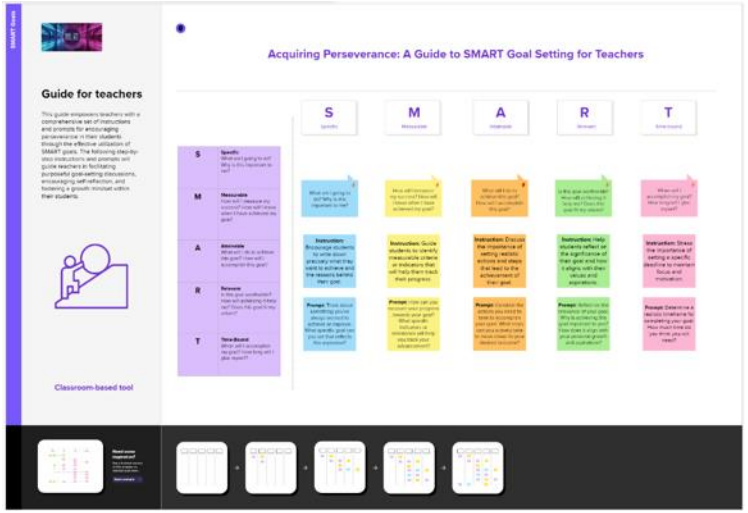
Steps for Integrating the **Perseverance SMART Goals Tool** into STEM Education

01 | Accessing Mural

- Go to MURAL by clicking on https://app.mural.co/t/aceeu4992/m/aceeu4992/1690354260680/624485eba66d86b8fdc8fba853ffda6689023aec?sender=u33007655b058e0c372fb0249
- Input your name and email to visualise the tool.

ENTER YOUR INFORMATIO N HERE





THIS IS HOW THE TOOL LOOKS

02 | Introduction to the tool

- Read the description on the left, which will assist you in leading your students through the process of setting SMART goals.

03 | S - Specific

- Go to the "S" section on the Mural and encourage students to write down precisely what they want to achieve and why it is important. Use the prompt given to help them.

04 | M - Measurable

- Proceed to the "M" section on the Mural and guide students to identify measurable criteria or indicators for tracking progress. Offer the prompts to inspire them.

05 | A - Attainable

- Move to the "A" section on the Mural and discuss the importance of setting realistic actions and steps to achieve the goal. Provide the prompt for students to gain more insights.

06 | R - Relevant

- Access the "R" section on the Mural and help students reflect on the significance of their goal and its alignment with their values. Provide the prompt to a clearer input.

07 | T - Time bound

- Move to the "T" section on the Mural and emphasize the importance of setting a specific deadline for goal achievement. Provide the prompt to help them.

CRITICAL THINKING, PROBLEM-SOLVING, SYSTEMS THINKING

02

02|CRITICAL THINKING, PROBLEM-SOLVING, SYSTEMS THINKING

This cluster involves an array of skills such as analytical thinking, cognitive processes, critical thinking, decision-making, problem framing, complex problem solving, reasoning, ideation, and systems skills (Līce, et al., 2023). Thinking skills and competences involve the application of mental processes like gathering, conceptualizing, analysing, synthesising, and evaluating information obtained from observation, experience, reflection, reasoning, or communication (ESCO, 2023 as cited in Līce, et al., 2023). These skills empower individuals to assess and utilise diverse information to plan activities, achieve goals, resolve challenges, and undertake complex tasks in both routine and novel contexts.

Critical thinking requires intellectual discipline, according to the Foundation for Critical Thinking. It refers to the capacity to analyse information The process of actively and successfully conceiving, applying, analysing, synthesising, and/or evaluating knowledge as a basis for belief and action. Problem-solving, in contrast, refers to the process of defining a problem, identifying its source, and choosing potential solutions, then putting a solution into practice (Foundation for Critical Thinking, 2023).

In the STEM landscape, understanding **critical thinking, problem-solving,** and **systems thinking** not only facilitates effective decision-making but also contributes to the holistic development of individuals prepared to excel in intricate scenarios.

TOOL DESCRIPTION + ITS RELEVANCE

Ishikawa

"An Ishikawa diagram (Fishbone) or cause-and-effect diagram, is a visualisation tool used to identify the potential causes of a problem or event."

The Ishikawa diagram finds problems' root causes and groups them into specific categories. The main goal is to identify and analyse the impact of various factors on a particular situation or event. It was created by Kaoru Ishikawa, a Japanese quality control expert, and resembles the skeleton of a fish, with the "ribs" representing the causes of an event and the outcome appearing at the head of the skeleton.

By integrating the Ishikawa diagram into regular pedagogical practices, educators can develop necessary student skills for future work.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The Ishikawa diagram can be integrated into lesson plans to teach students how to identify and analyse the potential causes of a problem or event.

The Ishikawa diagram is a helpful tool in study courses to visualise the potential causes of a specific event or problem, troubleshooting processes, and make root cause analysis.

LEARNING OUTCOMES

By using the the Ishikawa diagram, students will be able to:

- Improve their understanding of cause-and-effect relationships.
- Improve ability to identify potential risks and difficulties.
- Develop the ability to create mitigation plans.
- Enhance decision-making skills and idea-generation skills.
- Improve collaboration and communication.

TEACHING METHODS USED

To implement the Ishikawa diagram tool effectively, the following teaching methods can be used:

- **Teamwork**: Shifts the focus away from the teacher, fosters unity among students, puts the collective knowledge and experiences of participants to use, and allows students to search and find solutions to problems independently.
- **Group discussions:** They allow students to engage in discussions to help them share their ideas and problem-solving ways.
- **Case Study Analysis**: Allows students to analyse the challenges, problems, solutions, and outcomes presented, promoting analytical skills.
- **Student presentation:** Allow students to present their vision and solutions to problems and justify and argue their point of view.
- **Individual work:** This can be helpful if students' abilities, interests, or circumstances are unique and require an adapted teaching approach.

SPECIFIC RESOURCES/EQUIPMENT USED

- Ishikawa (fishbone) diagram template.
- Whiteboards or flip charts.

TARGET AUDIENCE (their characteristics and level)

The target audience for using Ishikawa diagram will be STEM educators, educational technologists, administrators, and students seeking to understand the direction in which STEM industry are headed. It is also very relevant to STEM students of various programmes and at different semesters in their studies, and those with:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Ishikawa diagram tool:

- Enhances student engagement in discussion and new idea generation.
- Helps to see the cause-effect relationship.
- Develops skills such as problem-solving, critical thinking and reasoning.

Disadvantages of the Ishikawa diagram tool:

- May require additional time to share ideas.
- Some students may not have the desire to work in a team with others.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Possible adaptations and variants of the Ishikawa diagram are:

- **Simple Fishbone Diagram:** This version has no predetermined categories, so it is the most flexible. Rather than starting with the method, materials, etc., the team begins by considering their categories. It leaves everything open to be specific to the topic at hand. That means any team could use it for any reason.
- **3Ms/Man machine material fishbone:** The 3M diagram, the man, machine, and material fishbone, organises information into three categories: manpower, machinery, and materials.
- **The 4S Fishbone Diagram:** A service organisation commonly uses this, which includes categories like systems, surroundings, skills, and suppliers. The Fishbone Diagram can be useful in a factory's internal services. It is beneficial if you want to involve the whole facility in problem-solving.
- **The 6Ms Ishikawa diagram:** Use six categories in their Fishbone diagrams: machine, methods, measurements, materials, manpower, and environment. It covers all the major aspects that come across in manufacturing).
- **8P Fishbone Diagram:** The 8P Fishbone Diagram derives its name from its eight categories. These categories all start with the letter “P”. The categories are Price, processes, people, product, procedures, promotion, policies, and physical location. This is also popular in administrative functions and the service industry.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **Self-assessment:** Students can reflect on their problem-solving skills.
- **Peer assessment:** Students can provide feedback on each other's problem-solving.
- **Analyse solution performance:** Students, teachers or professionals can give an evaluation to understand whether the solution delivered is realistic and implemented in real life.

GUIDE FOR EDUCATORS

Steps for Integrating the **Ishikawa diagram *(Fishbone)*** **Tool** into STEM Education

01 | Research and discovery

- Access the Ishikawa diagram templates available in different web pages, example:
- www.smartdraw.com CLICK TO **VIEW**
- www. templatelab.com CLICK TO **VIEW**
- Excel template CLICK TO **VIEW**

02 | Define the problem

- Find a challenge or problem that is important for students to solve.
- Determine the exact problem that you want to analyse using the Ishikawa diagram.

03 | Lesson integration

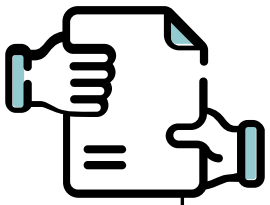
- Plan a lesson around the chosen problem or case study.
- Determine if any supplementary information, materials or technologies are needed.
- Introduce the key categories or factors that could potentially contribute to the problem. These categories are represented as the «ribs» of the fishbone diagram.

04 | Student engagement

- Ask students to reflect on the problem's context and significance to understand causes and effects. Discuss and agree on the problem statement.
- Encourage students to brainstorm and identify the possible causes that could contribute to the problem. These causes are represented as smaller branches off the main categories.

05 | If there is a deadlock

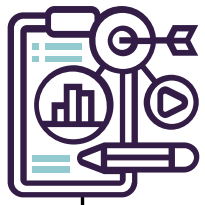
- Be a facilitator/mentor for students, help them understand the causes of problems, and if necessary, get involved by asking evocative questions such as «Why does this happen?»



06 | Creation

- Once the students have identified the key categories and the actual causes, they can create a fishbone diagram. When diagram is complete, students analyse the causes and their relationships to the problem.
- Use the diagram to guide discussions and decision-making on how to address the root causes. This helps in developing strategies and action plans to resolve the problem.

07 | Project assignment, review and feedback



- Encourage students to explore and apply what they have learned in a practical manner.
- Distribute feedback surveys to gauge the effectiveness of the integrated method.
- Peer Review: Share experiences and gather feedback from fellow educators about integration.
- Collaborate on refining the approach for better outcomes in future lessons.

08 | Iterate and enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.

TOOL DESCRIPTION + ITS RELEVANCE

«Lego Serious Play is a facilitation methodology developed by The Lego Group to improve creative thinking, problem – solving and communication»

Lego serious play (LSP) offer learners a unique and effective way of handling complex challenges and a kick start to development!

The aim of LSP is to create imaginative and effective ways to develop innovative strategies, build strong teams and to deal with difficult challenges. By «thinking with your hands» and through serious play with LEGO® bricks, learners cultivate their creativity and innovative capabilities.

LSP is a method that helps to communicate, formulate and organise thoughts and ideas to make strategic decisions and solve problems in business, teamwork and individual personal development.

By integrating LSP into regular pedagogical practices, educators can stay at the forefront of STEM education, development they equip students with problem-solving, critical thinking and communication skills for the future.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

Lego Serious Play is a useful tool in study courses because it offers a methodology to look at a problem or situation from the outside. It is a process designed to encourage active participation and collaboration among participants to explore complex issues, find innovative solutions, and hear the views of all team members of future vision.

It is also an excellent opportunity to be creative, understand each other, and actively participate in teamwork.

LEARNING OUTCOMES .

By using the Lego Serious Play tool, students will be able to:

- Improve their understanding of creating a vision for the future.
- Improve ability to identify factors that influence development.
- Enhance the ability to analyse scenarios and look for solutions.
- Develop the ability to reach agreement in the team on how they can best work together to achieve optimum results.
- Foster the ability to collect thoughts and ideas, identify new opportunities and choose the right strategy.
- Improve decision-making, idea-generation skills, collaboration and communication.

TEACHING METHODS USED

To implement the LSP tool effectively, the following teaching methods can be used:

- **Certified faciliators:** Only certified facilitators can run sessions in Lego Serious Play, therefore allowing students interaction and deeper dives into the gamification.
- **Teamwork:** Helps to divert the focus from the teacher, unite the students, "put into use" the knowledge and experience of each participant, and allows students to search and find solutions to problems independently.
- **Group discussions:** After students get a task, facilitate classroom discussions to engage them in conversations to help them share their ideas and future vision.
- **Project-Based Learning**: involves engaging students in real-world projects that are relevant and meaningful. In a session, participants can work on projects that require problem-solving. They can build models that represent solutions to real-world challenges or design prototypes for innovative ideas.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Lego bricks as the primary building material.
- Artefact Cards are a tool that can be used to enhance the LSP experience.
- Facilitator with appropriate training or experience, as the effectiveness of the process depends on the facilitator's ability to guide the session safely and creatively to encourage participants' creativity.

TARGET AUDIENCE (their characteristics and level)

The target audience for using Lego Serious Play will be STEM educators, educational technologists, administrators, and students seeking to understand the direction in which STEM industry are headed. It is also very relevant to STEM students of various programmes and at different semesters in their studies, and those with:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Lego Serious Play tool:

- Enhances student engagement in discussion and new idea generation.
- Improves innovative approaches and decision-making
- Enhances student integrate in new teams with new members and cultures.
- Develops skills such as problem-solving, critical thinking, reasoning and teamwork.

Disadvantages of the Lego Serious Play tool:

- May require additional time to share ideas.
- Some students may not want to work in a team with others.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Lego Serious Play is a highly flexible tool with numerous variations, making it suitable for various applications. The key is to understand your goals and needs and adapt LSP to achieve specific results. For instance, it can be applied in:

- **Sample target groups:** Can be adapted to different sample target groups such as business teams, educational institutions, social enterprises, etc.
- **Topics and questions:** Tailoring questions and exercises to suit the specific problem or issue you want to address.
- **Tailored scenarios:** Create specific scenarios or processes to use the Lego Serious Play in particular situations, such as strategy planning, conflict resolution or new product development. Etc.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **Classroom Discussions:** Host open discussions where students can share their views and experiences with the new method integrated.
- **Peer assessment:** Students can provide feedback on each other's problem-solving, cooperation, communication, and idea generation.
- **Analyse solution performance:** Students, teachers or facilitators can give an evaluation to understand whether the solution is original and viable.
- **Presentation and defense:** Ask students to present their projects to the class, defending their choices and methodologies. This not only assesses their comprehension but also evaluates their communication skills and storytelling ability.

Steps for Integrating the Lego Serious Play Tool into STEM Education

01 | Time and place

- Schedule a time and place for the educators, students, and certified facilitator for the Lego Serious Play session.

When preparing for the session, you need the following:

- **Lego bricks:** A set of Lego bricks that will allow participants to build different models and constructions to express their ideas and thoughts.
- **Facilitator:** Facilitators are trained professionals who provide management, encourage discussion, and ensure the session is constructive.
- **Session planning:** A Lego Serious Play session requires careful planning. You need to identify the objectives, select participants and identify the time, place and resources to conduct the session.
- **Tasks and questions:** To encourage thinking and communication, the facilitator prepares tasks to help participants construct models reflecting their thoughts on the topic.

02 | Introduction and inspiration

- Introduce students to the facilitator who will lead the session so that they can explain the methodology and give the assignment.
- Ask students to work together to create a shared model and be open to new challenges.

03 | Student engagement

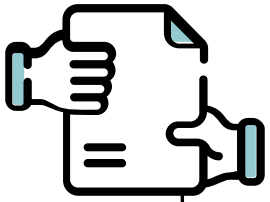
- Discuss the task with the team.
- Build Lego models to represent ideas.
- Use storytelling: participants share their stories with one another.

04 | Ensure a creative environment

- Allow the facilitator to guide the session and work with the students to build Lego models.

05 | Be positive and open-minded:

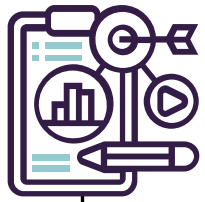
- Recognise that leaders do not have all the answers and success in teamwork depends on hearing all voices in the classroom.



06 | Discussion and questions

- Analyse your and others' models to understand better and solve problems.
- Ask questions related to the model or the relationship between models, listen to storytelling and go deeper into the reasoning.
- At the end of the session, summarise the essential findings and solutions. These outputs could be used for future work, decision-making or planning.

07 | l Review and feedback



- Conduct classroom discussions post-task to evaluate understanding.
- Distribute feedback surveys or reflection essays to gauge the effectiveness of the integrated method.

08 | Iterate and enhance

- Based on feedback, make necessary adjustments to the lesson plan to improve the Lego Serious Play session.
- Integrate the Lego Serious Play method into your lessons as an interactive way to solve problems and find new solutions.

CLICK TO **VIEW**

TOOL DESCRIPTION + ITS RELEVANCE

TRIZ (Theory of Inventive Problem Solving)

"TRIZ (Theory of Inventive Problem Solving) is a systematic approach to problem-solving that combines an organized and systematic method for problem-solving with analysis and forecasting techniques."

The TRIZ technique recognizes that certain patterns emerge whenever inventions are made. It involves a technique for problem-solving created by observing the commonalities in solutions discovered in the past. It helps individuals develop systems thinking and problem-solving skills. TRIZ uses analysis and synthesis to find and apply the most effective solutions to complex engineering and technical tasks. That identifies and codifies principles and uses them to make the creative process more predictable.

Creative problem-solving involves finding solutions and adapting them to address various challenges. TRIZ is a systematic approach and methodology developed to promote new idea generation, problem-solving, and innovation.

By integrating TRIZ into regular pedagogical practices, educators can stay at the forefront of STEM education, ensuring they equip students with the most relevant skills and knowledge for the future.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

TRIZ works alongside and supports other toolkits, and it is particularly powerful for getting teams to work together to understand problems effectively, collectively generate ideas and innovate.

TRIZ can be integrated into any course that aims to develop creativity, problem-solving, and innovation skills. However, it is essential to provide a thorough explanation of TRIZ and adapt it to the specific course of study to ensure students understand its relevance and applicability within their specific learning contexts. The most suitable courses for TRIZ integration include Engineering, Industrial Design, Innovation, and Product Development.

LEARNING OUTCOMES

By using the TRIZ tool, students will be able to:

- Improve their ability to think systemically by analysing problems and identifying their root causes to develop effective solutions.
- Develop the ability to generate several solutions to a single problem using principles and strategies.
- Understand how to find and use existing resources and technologies to create innovations.
- Develop critical thinking to critically review existing solutions and technologies in search of opportunities for improvement.
- Improve communication and collaboration skills in teamwork, finding the best solutions.
- Improve project management skills in developing new products or technologies based on innovative solutions.

TEACHING METHODS USED

To implement the TRIZ tool effectively, the following teaching methods can be used:

- **Lectures and presentations:** Lectures and presentations provide an overview of the basic concepts, development and principles of TRIZ.
- **Interactive Discussion:** Discussions can help students to exchange ideas and experiences related to TRIZ principles and their application.
- **Treasury studies**: A study of actual treasury study using TRIZ can provide concrete examples and decisions on the effectiveness of TRIZ principles.
- **Project work:** Students can offer projects that require TRIZ to solve real problems or develop new innovations.
- **Group work:** Group work allows students to collaborate and generate ideas to find common solutions to a problem.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Study materials on TRIZ principles, applications, and examples.
- Worksheets and templates.
- Whiteboards or flip charts.
- Shared documents.

TARGET AUDIENCE (their characteristics and level)

The target audience for using TRIZ will be STEM educators, educational technologists, administrators, and students seeking to understand the direction in which STEM industry are headed. It is also very relevant to STEM students of various programmes and at different semesters in their studies, and those with:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the TRIZ tool include:

- Improves students' teamwork and problem-solving skills.
- Provides a systematic and structured approach to problem-solving.
- Focuses on fostering innovation through new and creative solutions.

Disadvantages of the TRIZ tool include:

- Additional time and effort may be needed to understand the methodology, which may be time-consuming.
- The tool's effectiveness depends on the student's willingness to engage in problem-solving and their understanding of the overall vision of the system.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Some ideas on possible adaptations of the TRIZ tool include:

- **Workshops**: TRIZ has a methodology that can be adapted to different sectors, problems, and contexts.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **Classroom Discussions:** Host open discussions where students can share their views and experiences with the new method.
- **Self-assessment:** Students can reflect on their problem-solving skills and involved teamwork.
- **Peer assessment:** Students can provide feedback on each other's problem-solving.
- **Invention competitions:** competitions where participants create innovative solutions using TRIZ principles.
- **Analyse solution performance:** Students, teachers or professionals can give an evaluation to understand whether the solution delivered is realistic.
- **Presentation and Defense:** Ask students to present their projects to the class, defending their choices and methodologies. This not only assesses their comprehension but also their communication skills and confidence in their work.

02 | Selection and curation

- Clearly define the objectives you want to achieve using the TRIZ method. Then prepare materials that give an overview of the principles of TRIZ.

03 | Lesson integration

- Plan a lesson or module around the chosen content, where can use TRIZ.
- Determine if any supplementary materials or technologies are needed

04 | Student engagement

- Introduce students to TRIZ invention models, problem-solving, innovative thinking techniques, and other tools to help solve problems.
- Give students specific tasks to apply TRIZ principles, The 40 Inventive principles to problem-solving. Ideally, provide a variety of tasks so that students can use TRIZ in different situations.
- Encourage group work and cooperation so students can combine their skills, thoughts and ideas to solve problems.

GUIDE FOR EDUCATORS

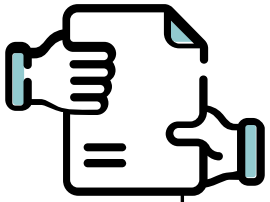
Steps for Integrating the TRIZ Tool into STEM Education

01 | Research and Discovery

- Familiarise yourself with the method before the training starts, ensure that you understand the principles and techniques of TRIZ, and study the examples to tell the students.
- Use TRIZ tools (also digital tools such as support https://www.triz40.com/TRIZ_GB.php) to derive new solution paths.
- You can also consider https://triz-trainer.com/

05 | Consider inviting guests (optional):

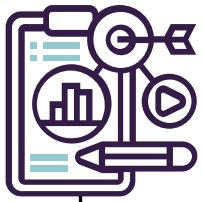
- TRIZ is a complex method, so it is desirable to have a TRIZ trainer during the sessions.



06 | Project assignment

- Give feedback on students' work and creative thinking. Suggest improvements and encourage the involvement of all students.
- Evaluate what aspects of the TRIZ were most effective and how they could be improved.

07 | l Review and feedback



- Give feedback on students' work and creative thinking. Suggest improvements and encourage the involvement of all students.
- Conduct classroom discussions post-project to evaluate understanding.
- Distribute feedback surveys or reflection essays to gauge the effectiveness of the integrated method.

08 | Iterate and enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.
- Return to TRIZ and perhaps integrate the method into other lessons or courses.

COMMUNICATION, COLLABORATION, TEAMWORK

03

03|COMMUNICATION, COLLABORATION, TEAMWORK

This cluster captures a diverse range of skills, including collaboration, communication, relationship development, engagement, interpersonal skills, social skills, teamwork effectiveness, and more (Līce, et al., 2023).

As the ESCO framework highlights (ESCO, 2023 as cited in Līce, et al., 2023), social and communication skills refer to the capacity to engage constructively and productively with others. In turn, these skills encompass social interactions, interpersonal abilities, and the art of navigating social situations skilfully.

In STEM, effective **communication, collaboration,** and **teamwork** serve as the connective tissue that fosters innovation, knowledge exchange, and the collective pursuit of breakthroughs. The ability to convey complex ideas clearly, collaborate across multidisciplinary teams, and navigate social dynamics with sensitivity empowers individuals to contribute meaningfully to the advancement of science and technology.

TOOL DESCRIPTION + ITS RELEVANCE

Pyramid Building Team Activity

The **Pyramid Building Team Activity** uses strings and a rubber band for students to collaboratively construct a cup pyramid, promoting patience, perseverance, and teamwork. Integrated through a lesson emphasising teamwork and communication, it's ideal for team building sessions, communication training, and cross-curricular lessons. Students can expect enhanced team dynamics, communication, and problem-solving skills.

The hands-on activity requires cups, rubber bands, and strings, and is versatile for all ages. While it offers adaptability and real-world application, success demands careful guidance. Variations can modify complexity, materials, or roles, and adaptations can address group sizes or learning objectives. Assessment methods include observations, reflections, and evaluations, offering a rounded view of skill development.

Using a device composed of four strings attached to a rubber band, each student in the group grabs one of the strings. Collaboratively, they utilise this device to lift the cups. This is done by expanding the rubber band over a cup and then contracting it to grip the cup. They then carefully place the cups atop each other to construct a pyramid! This hands-on challenge is an exercise in patience and perseverance

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

- Enhancing Teamwork Through Cup Pyramid Building serves as an effective resource for educators interested in fortifying team skills and effective communication among students. When teachers are searching for hands-on activities that can improve group dynamics and problem-solving, this simple yet meaningful exercise stands out.

- By integrating this Cup Pyramid Building activity, instructors can effortlessly introduce their students to the critical aspects of teamwork, clear communication, and inventive problem-solving. This keeps the lesson engaging while making sure students are prepared and knowledgeable about the key elements of group work and real-world scenarios.

LEARNING OUTCOMES

Through this activity, students will be able to:

- Stay up-to-date about the vital role of teamwork and communication, connecting classroom experiences to real-world applications.
- Access practical exercises that refine their group work and conversational skills.
- Explore various team roles and collective responsibilities, broadening their understanding of how to work efficiently as a group.
- Engage in hands-on activities that promote creative thinking and effective problem-solving.
- Interact and share ideas, cultivating an environment of ongoing learners.

TEACHING METHODS USED

To implement the Pyramid Team Building Activity tool effectively, the following teaching methods can be used:

- **Experiential Learning:** Students get hands-on experience with the rubber band and string tool, learning by doing.
- **Group Work:** Team activities encourage collaboration among students.
- **Demonstration:** Visual guidance is provided to show how the tool should be used.
- **Guided Practice:** Teacher support is available during practice to help students master the activity.
- **Reflective Discussions:** Time is set aside for students to discuss their insights and analyses of the activity.
- **Differentiation:** The activity is adapted to suit different skill levels, making it inclusive.
- **Assessment and Feedback:** Understanding is measured

SPECIFIC RESOURCES/ EQUIPMENT USED

- Paper/plastic cups
- Rubber bands
- Strings

TARGET AUDIENCE (their characteristics and level)

The Pyramid Team Building Activity is suitable for students of all ages who are interested in STEM fields. It is designed to be accessible for individuals with varied experience levels, learning styles, and interests. Some of their specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Team Building Pyramid are:

- Can be used to teach multiple skills like teamwork, collaboration, and communication.
- Provides practical, tactile learning experiences.
- Can be adjusted to fit different learning environments and needs.
- Teaches skills that are useful in everyday life.

Disadvantages of the Team Building Pyramid are:

- The activity's success depends on effective guidance from the teacher.
- Care is needed to make sure all learners' needs are considered.
- The activity may require adjustments depending on the learning environment.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

- **Complexity of Structures:** Increase or decrease the complexity of the structure to be built, such as creating different shapes or larger pyramids.
- **Time Challenges:** Introduce a time limit for added pressure and excitement or allow more time for strategic planning and reflection.
- Different Materials: Utilise other objects besides cups, such as blocks or balls, to alter the challenge.
- **Role Assignments:** Assign specific roles within the team, such as a leader, strategist, or communicator, to explore different aspects of teamwork.
- **Adjusting Group Size:** Modify the activity for different group sizes, whether pairs, small groups, or larger teams, to suit the class size or focus on different collaboration dynamics.
- **Incorporating Learning Objectives:** Integrate specific learning objectives from other subjects, such as mathematical concepts in building shapes or historical teamwork examples.
- **Assisting Diverse Learners**: Provide additional support, guidance, or modified materials for learners with different abilities or needs, ensuring inclusivity.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **Behaviour Observation:** Teachers watch students during the activity to gauge teamwork and communication.
- **Post-Activity Discussions:** Reflections and talks after the activity provide insights into collaboration.
- **Peer and Self-Evaluations:** Students assess themselves and each other for a rounded view.
- **Performance Assessments:** Clear criteria are used to measure skills.
- **Future Activity Integration:** Observations can be linked with future tasks for continuous assessment.
- **Journaling:** Written reflections offer deeper insights.

GUIDE FOR EDUCATORS

Steps for Integrating the Pyramid Team Building **Tool** into STEM Education

01 | Research and Discovery

- Access this YouTube video Cup Stacking Team Building Activity - YouTube for a visual tutorial on how to implement the tool
- Ask all educators involved to try the activity amongst themselves to put it to the test!

02 | Selection and curation

- Once the educators have witnessed the effects of the Team Building Pyramid Activity, they can decide on its implementation in their classrooom.

03 | Lesson integration

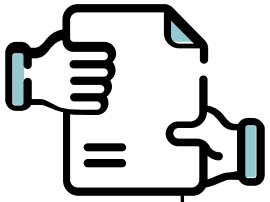
- Plan a lesson or module around the activity.
- Make sure to have the necessary equipment! This includes, paper/plastic cups, rubber bands, strings

04 | Student engagement

- Introduce the topic using the Youtube video as a reference.
- Engage students by selecting a group to come to the front of the classroom and demonstrate it to the rest of the class.

06 | Project assignment

- Once the class know how to complete the task, split the students into groups of 4 or 5



07 | Review and feedback

- Have a brief chat after the activity to gauge students' understanding and thoughts on perseverance and teambuilding.
- Feedback Surveys or Essays. Hand out short questionnaires or assign quick reflection tasks to measure the activity's impact.
- Peer Review with Educators. Talk to fellow teachers who've used the activity to discuss its effectiveness and possible improvements.

08 | Iterate and Enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.

TOOL DESCRIPTION + ITS RELEVANCE

Belbin Self-Perception Inventory

"The Belbin Self-Perception Inventory test is a behavioral tool used to assess how an individual behaves in a team environment."

The Belbin Self-Perception Inventory is a questionnaire that individuals complete online or on paper to assess their team role behaviors. Taking about 15 to 20 minutes, the Belbin test helps individuals determine how an individual behaves in a team environment.

It is a tool that scores people on how strongly they express behavioral traits from nine different team roles. It is relevant because the most successful teams have a mix of other people and different behaviors

By integrating the Belbin Self-Perception Inventory into regular pedagogical practices, educators can stay at the forefront of STEM education, ensuring they equip students with the most relevant skills for the future and teamwork.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

This tool can be integrated at the beginning of the course to identify students' roles in the team and determine each person's strengths for teamwork to be successful.

The Belbin Self-Perception Inventory test is a useful tool for individuals to understand their strengths and how to communicate more effectively with their team and manager. Therefore, this test is a useful tool for team building. It can be used: identifying team roles, improving communication, enhancing team performance, resolving conflicts and developing leadership skills.

LEARNING OUTCOMES

By using the Belbin Self-Perception Inventory test, students will be able to:

- Improve understanding of students' role in the team and their contribution to the common good in teamwork.
- Strengthen the development of their strengths.
- Increase their capacity to be involved and act in teamwork.
- Develop skills to collaborate in a team to achieve common goals.

TEACHING METHODS USED

To implement the Belbin Self-Perception Inventory tool effectively, the following teaching methods can be used:

- **Individual work:** Each person can take a particular test to determine their role in the team.
- **Interactive Discussions:** After completing the test and receiving their results, students can talk about them in the group.

SPECIFIC RESOURCES/EQUIPMENT USED

- The Belbin Self-Perception Inventory test.
- Instructions for performing the test and explanation of results.

TARGET AUDIENCE (their characteristics and level)

The target audience forThe Belbin Self-Perception Inventory test include STEM educators, educational technologists, administrators, and students seeking to understand the direction in which STEM industry are headed. It is also very relevant to STEM students of various programmes and at different semesters in their studies, and those with:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages:

- Enhances student engagement in teamwork.
- Contribute to teamwork, the area where you feel most confident.
- Develops skills such as communication, collaboration, and teamwork.

Disadvantages:

- May require additional time to engage in teamwork and share ideas.
- Some students may not have the desire to work in a team with others.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Possible adaptations of The Belbin Self-Perception Inventory test tool include:

- Using the **free trial** version (paper or digital) or the **paid** version with an in-depth analysis of the individual's role in the teamwork.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the acquisition of the skill through the Belbin Self-Perception Inventory tool, the following assessment methods can be considered:

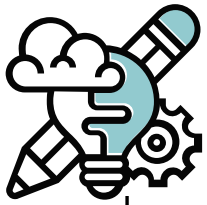
- **Self-assessment:** Students can reflect on their communication, collaboration, and teamwork skills.
- **Peer assessment:** Students can provide feedback on each other's engagement in teamwork.
- **Classroom Discussions:** Open discussions where students can share their views and experiences with the new content or method integrated.

GUIDE FOR EDUCATORS

Steps for Integrating the **Belbin Self-Perception Inventory Tool** into STEM Education

01 | Research and discovery

- Access the Belbin platform https://www.belbin.com/ create an account (*if you want*) on SignUp (belbin.com)
- Get The Belbin Self-Perception Inventory test https://www.belbin.com/ or Belbin Team Roles Self Perception Inventory - WordPress.com (Word)



02 | Preparation

- Study the instructions for taking the test so that you can assist students with completing the test if needed.
- Take a postal test to discover your strengths.

03 | Lesson integration

- Plan the lesson and content that requires teamwork, giving students individual tests to determine their role in the team before starting the teamwork.

04 | Student engagement

- Distribute the test to each student individually. Ask them to read the completion instructions carefully, consider their answers thoughtfully, and select the most appropriate choices.
- Encourage students to engage in discussions or participate in Q&A sessions if it aids in completing the test.

05 | Feedback

- Discuss results with students.
- Conduct classroom discussions about discovered team roles.
- Share experiences and gather feedback from fellow educators.

ADAPTABILITY, RESILIENCE, AND STRESS RESISTANCE

04

04|ADAPTABILITY, RESILIENCE, AND STRESS RESISTANCE

This cluster encompasses a range of interrelated abilities, including adaptability, agility, coping with uncertainty, flexibility, perspective-taking, cognitive flexibility, resilience, stress resistance, and stress tolerance (Līce, et al., 2023).

The current employment landscape is characterized by boundaries between roles, organisations, and industries. Individuals frequently navigate careers involving diverse positions and contexts, emphasising the significance of adapting to change and embracing continuous learning as central competencies within the labour market. This dynamic environment demands permanent self-adjustment and the capability to manage shifting contexts effectively (Līce, 2019 as cited in Līce, et al., 2023)

Furthermore, adopting a flexible and proactive viewpoint towards work enhances an individual's capacity to capitalize on a broader spectrum of opportunities. This readiness to accommodate various changes opens doors to roles demanding additional skill acquisition (Wittekind et al., 2010 as cited in Līce, et al., 2023). In the constantly changing landscape of STEM, individuals who master the art of **adaptability, resilience,** and **stress resistance** stand equipped to navigate change, uncertainty, and challenges, thus enhancing their potential to succeed within this dynamic field.

TOOL DESCRIPTION + ITS RELEVANCE

MARSHMALLOW CHALLENGE TOOL

"The Marshmallow Challenge is an interactive team-building and creativity exercise."

The Marshmallow Challenge is a group activity in which participants must construct a freestanding structure using only sticks (usually spaghetti), tape, rope and marshmallows – to be placed on the top of the structure.

The main goal is for teams, comprised of 3 to 5 members, to collaboratively build the tallest possible structure capable of supporting a marshmallow on top without collapsing.

Within a specified time, participants need to effectively communicate, think outside the box, and be open to adapting their approaches as they progress.

This engaging activity is frequently used in various environments, including schools and workplaces, to promote teamwork, problem-solving skills, and the valuable lesson of learning from mistakes.

Marshmallow Challenge tool can be used to improve the following skills: creativity, adaptability, resilience and stress resistance.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The Marshmallow Challenge tool can be used in classrooms at the beginning of the semester as it will improve students' skills for future joint activities and throughout the rest of the semester.

LEARNING OUTCOMES

By using the Marshmallow Challenge tool, students will be able to:

- Demonstrate effective teamwork skills and the ability to communicate and cooperate to achieve common goals.
- Exhibit creative thinking and innovative problem-solving skills when working with limited resources during the construction process.
- Develop problem-solving abilities by identifying and overcoming challenges presented during the exercise.
- Manage time effectively by working within specified time limits, prioritizing tasks, and working efficiently.
- Adapt to changing circumstances and make improvements based on feedback and observations.
- Engage in a safe environment to take calculated risks, learn from mistakes, and embrace failure as an essential part of the learning process.
- Gain insights into how group dynamics influence teamwork and recognize the value of individual contributions within a team.

TEACHING METHODS USED

To implement the Marshmallow Challenge tool effectively, the following teaching methods can be used:

- **Interactive presentations:** They helps introduce the concept and implementation of the Marshmallow Challenge.
- **Learning by doing:** Students improve their ability to improvise, adapt, and work in a team during the tallest marshmallow construction development.
- **Group discussions:** They allow students to engage in discussions about the achieved results of the Marshmallow Challenge.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Personal computer or laptop
- Video projector (optional)
- Speakers (optional)
- 30 Sticks (wooden chopsticks or spaghetti sticks)
- 30 Marshmallows
- 1 Tape
- 1,5m of String

TARGET AUDIENCE (their characteristics and level)

The target audience are STEM students of various programs and at different semesters in their studies. Teachers are also part of the target audience since they will be the ones instructing students on how to use the tool. Some of the students' specific characteristics are:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Marshmallow Challenge tool are:

- Enhances student motivation and engagement.
- Participants learn to adapt to unexpected setbacks and changes in their plans during the activity.
- Effective communication becomes crucial to succeeding in the challenge, fostering better communication skills among participants.

Disadvantages of the Marshmallow Challenge tool are:

- Potential for Competition Over Collaboration: The activity may inadvertently promote a competitive atmosphere where teams focus on outdoing each other rather than fostering collaboration.
- Time Pressure: The imposed time limit could create stress and hinder creative thinking for participants who feel rushed.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Marshmallow Challenge tool can be adapted based on the specific needs and preferences of the students. Some possible variations include introduction of the aggravating circumstance halfway through the challenge, for example, take away one member or part of the building material or even shorten the challenge time by 3 min for competing teams.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the quality of Marshmallow Challenge tool usage, the following methods can be considered:

- **Self-assessment:** Students can personally, in written or oral form, reflect on the development of their skills: creativity, adaptability, resilience and stress resistance.
- **Goal progress tracking:** Students can track their progress and present updates periodically – using predefined questionaries or by reports in free form.

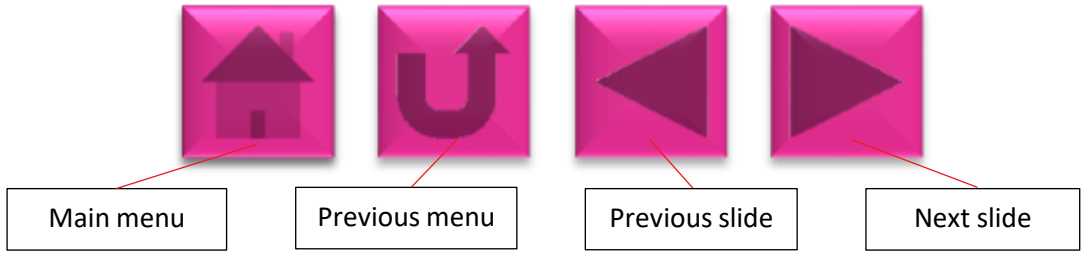
MARSHMALLOW CHALLENGE *TOOL IS AVAILABLE AT THE – COPY ENTIRE FOLDER:*
https://drive.google.com/drive/folders/1hn6zXaT69OFT5Y6xHueKI1SG3qmBpwoK?usp=sharing

GUIDE FOR EDUCATORS

Instructions on how to use the Marshmallow Challenge tool

START SCREEN:

For navigation through the presentation, **NAVIGATION BUTTONS** at the screen bottom are used:



After the **START button** is pressed, the **MAIN MENU** opens:

In the **MAIN MENU** the following buttons can be pressed:

1. **DESCRIPTION OF THE MARSHMALLOW CHALLENGE**
2. **OBJECTIVES OF THE MARSHMALLOW CHALLENGE**
3. **SKILLS DEVELOPED BY THE MARSHMALLOW CHALLENGE**
4. **DISCLAIMER**

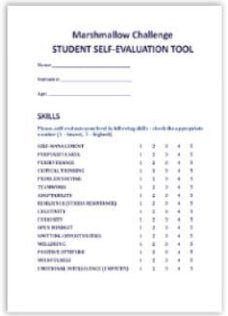
The central button of the **MAIN MENU** is the **START** button, which opens the **STEPS OF THE MARSHMALLOW CHALLENGE**:

Press the **STEP BUTTONS** to access slides with descriptions of each step. Alternatively, use the **NAVIGATION BUTTONS** to navigate through the steps when a specific one is open.

An essential step is **STUDENT EVALUATION AND TEAM FORMATION**, which includes the student evaluation form used to divide students into teams of 5 members with similar skills.

Student evaluation and team formation

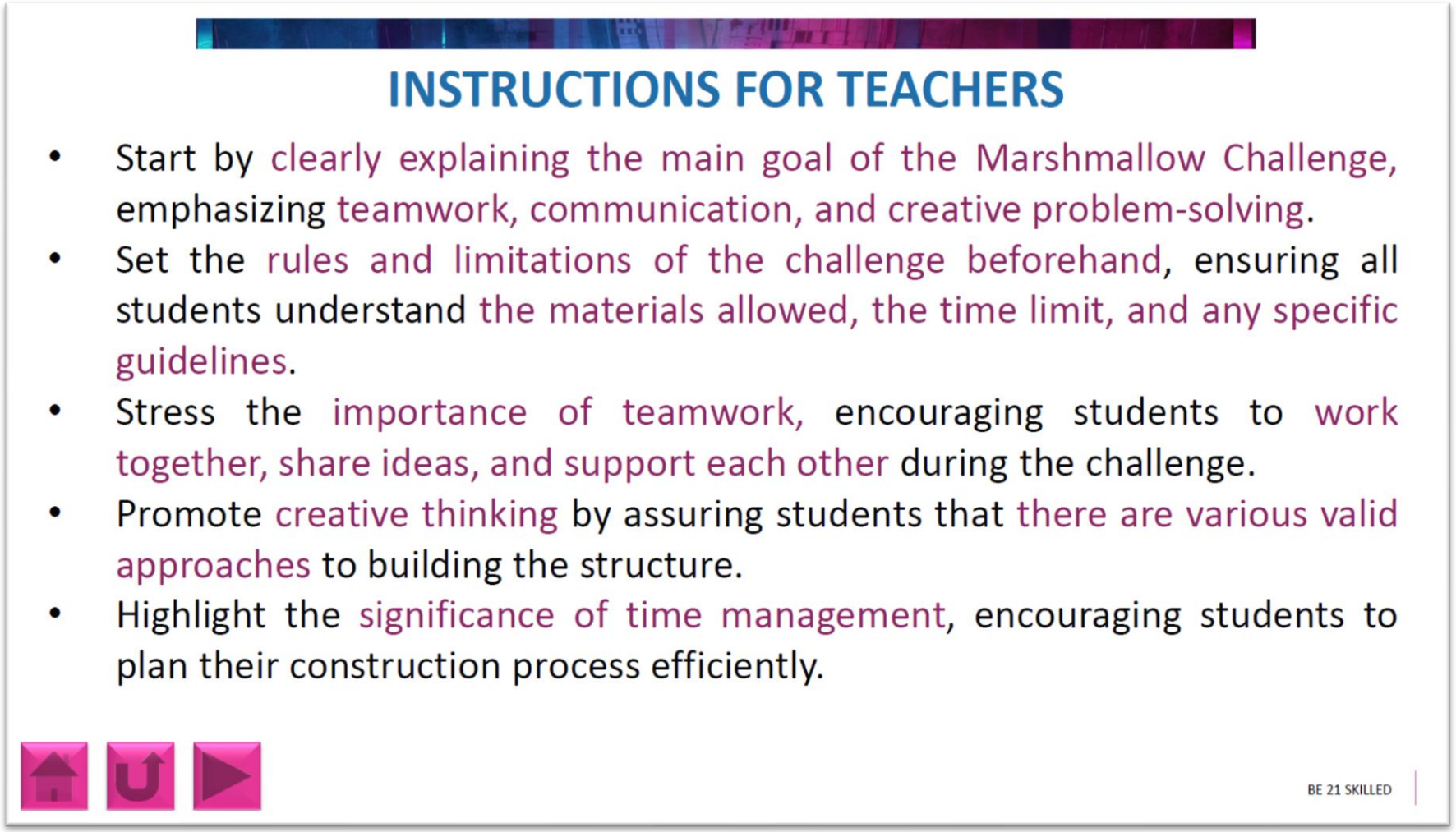
- The students' abilities should be assessed based on the following questionnaire (click):



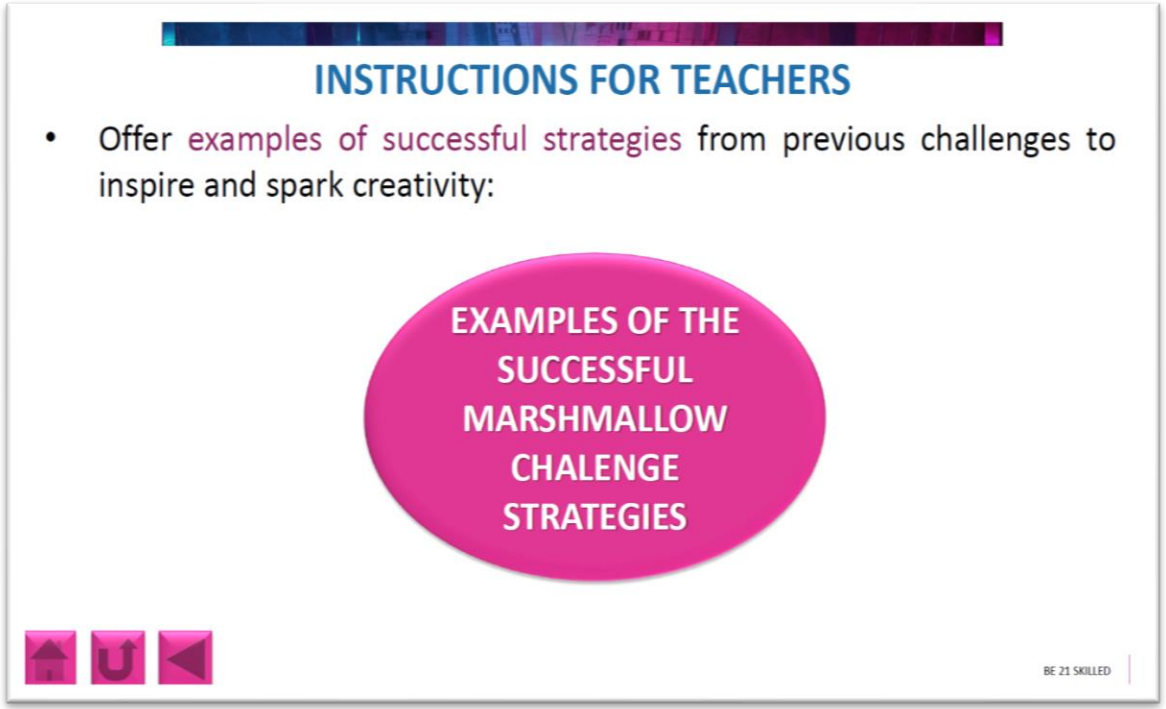
- After the evaluation, the students should be grouped into teams of 5 so the abilities of the teams are as equal as possible.

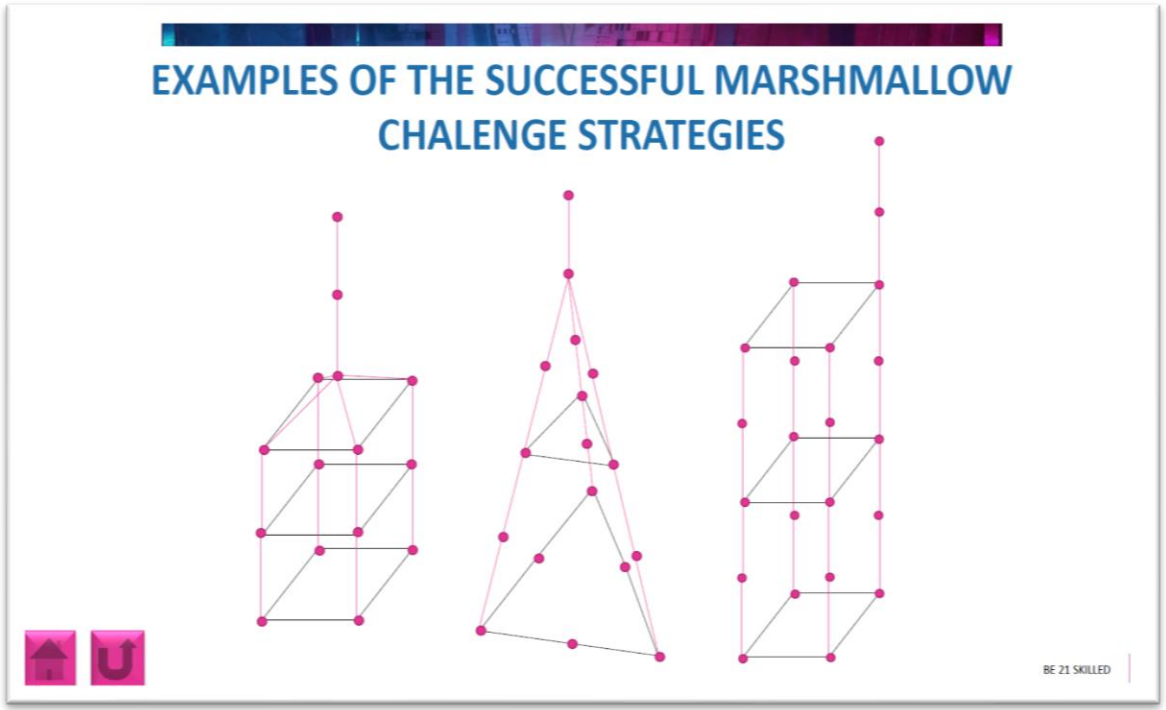
BE 21 SKILLED

The button **INSTRUCTION FOR TEACHERS** (from the **STEPS OF THE MARSHMALLOW CHALLENGE MENU**) leads to detailed instructions how to implement the Marshmallow Challenge.

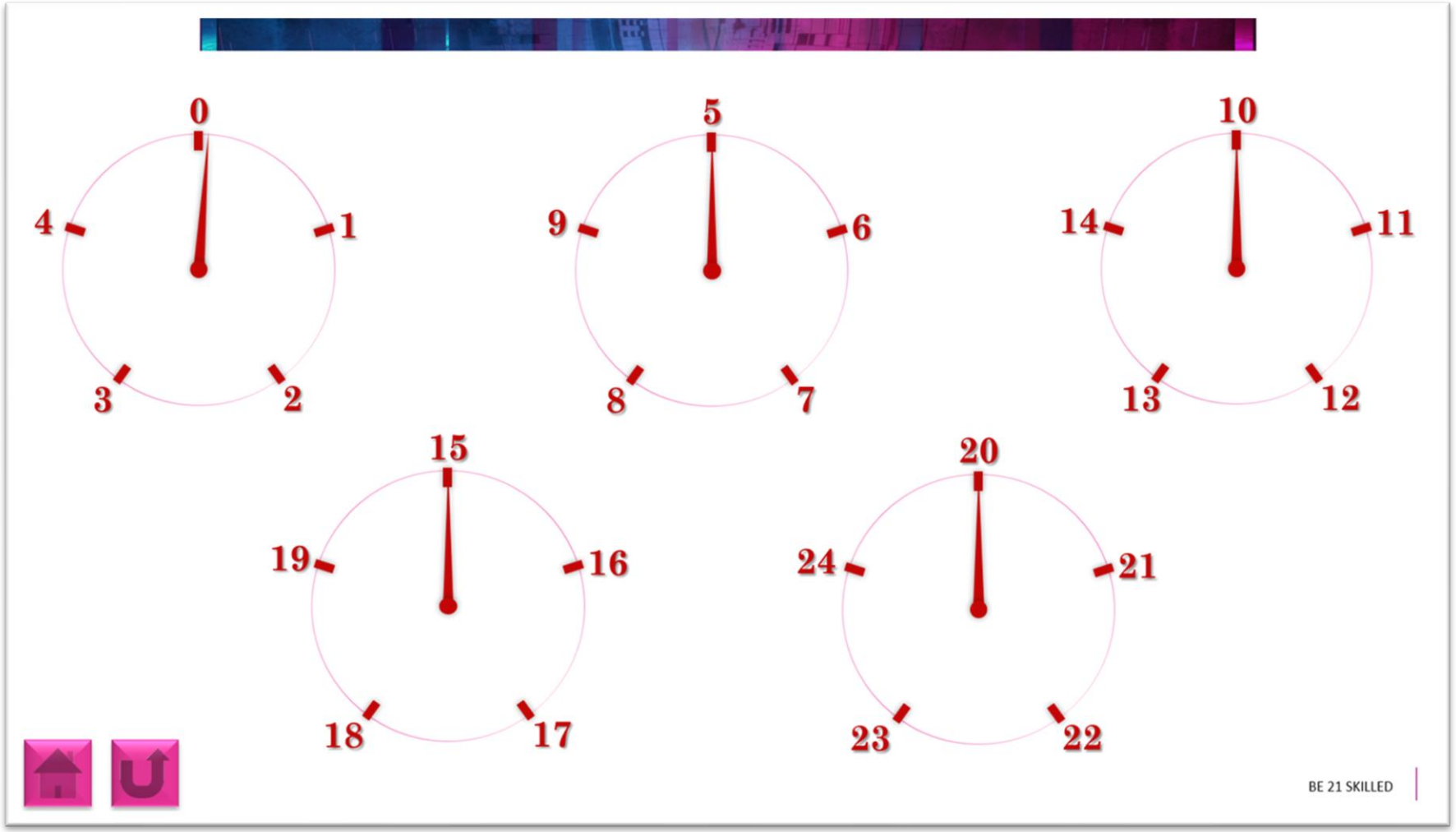


At the end of the **INSTRUCTIONS FOR TEACHERS**, there are E **EXAMPLES OF THE SUCCESSFUL MARSHMALLOW CHALENGE STRATEGIES** that can be shown to students.

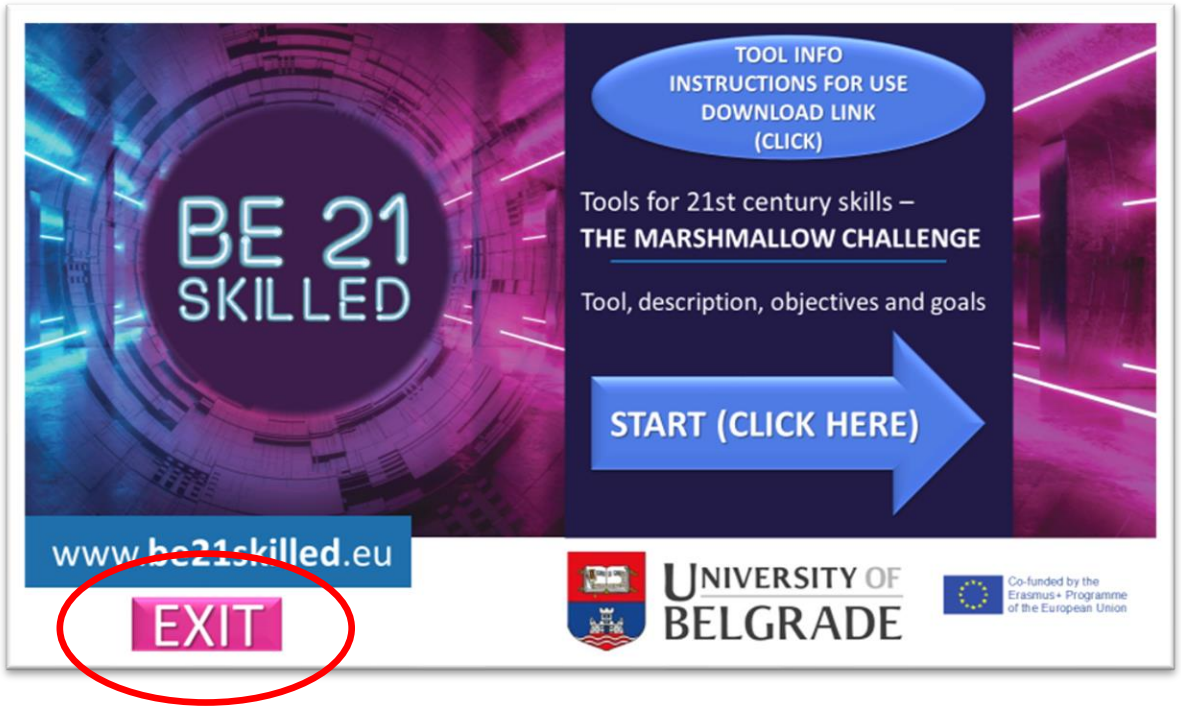




"When the arrow button **'START WITH THE MARSHMALLOW CHALLENGE COUNTDOWN'** is pressed in the **'STEPS OF THE MARSHMALLOW CHALLENGE MENU,'** it opens an automatic timer that measures the time for performing the challenge (25 minutes):



The application is closed via **EXIT button** in **START SCREEN** or the **MAIN MENU**:



TOOL DESCRIPTION + ITS RELEVANCE

POMODORO TECHNIQUE TOOL

"The Pomodoro Technique is a time management strategy created by Francesco Cirillo in the late 1980s to enhance productivity."

The Pomodoro Technique tool involves dividing work into focused intervals, called "Pomodoros" followed by short breaks.

By utilizing the Pomodoro Technique tool, individuals can enhance their focus, prevent burnout, and manage their time more effectively. The method encourages working with a sense of urgency during Pomodoro intervals and incorporating regular breaks to avoid mental exhaustion. This structured approach often aids concentration and increases productivity within a given timeframe.

While the traditional Pomodoro Technique suggests 25-minute work intervals and 5-minute breaks, the durations can be adjusted to suit individual preferences and work styles. The fundamental principle is to work in concentrated bursts and intersperse them with regular breaks to maintain productivity and overall well-being.

Pomodoro technique tool can be used, among other, to improve the following skills: self-management, adaptability, resilience and stress resistance.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The Pomodoro Technique tool can be utilised in both classroom settings and by individual teachers and students. In classrooms, it proves beneficial for study and homework sessions, group activities, classroom tasks and assignments, idea generation, creativity sessions, as well as reflection and self-assessment. Teachers can personally employ the Pomodoro technique for tasks such as lesson planning, grading and feedback, organizing teaching materials, engaging in professional development, collaborative work, and self-care with moments of reflection. Likewise, students can apply the Pomodoro Technique for various personal academic activities, including study sessions, homework assignments, test or exam preparation, research projects, essay or paper writing, memorization, flashcard practice, and reading assignments.

LEARNING OUTCOMES

By using the Pomodoro technique tool, students will:

- Enhance their ability to focus and maintain concentration on the task at hand using dedicated time blocks for work without distractions.
- Optimise their time management skills by setting specific intervals and tracking work progress, resulting in improved time allocation and task prioritisation.
- Prevent mental fatigue and burnout, maintain energy, and sustain performance throughout the day by incorporating regular breaks, with the technique.
- Enhance their ability to estimate the time required for various tasks, resulting in improved planning and the establishment of realistic goals.

TEACHING METHODS USED

To implement the Pomodoro technique tool effectively, the following teaching methods can be used:

- **Interactive Discussions:** Before the Pomodoro techique is implemented in classroom, discussions should be organised in order to dissect and debate the purpose of Pomodoro tehnique, ensuring comprehension and understanding of the Pomodoro technique concept.
- **Interactive presentation:** It helps introducing the concept and implementation of the Pomodoro technique.
- **Group discussions:** They allow to engage students in discussions about the Pomodoro technique concept and its goals and objectives

SPECIFIC RESOURCES/ EQUIPMENT USED

- Personal computer or laptop
- Video projector (optional)
- Speakers (optional)

TARGET AUDIENCE (their characteristics and level)

The target audience are STEM students of various programs and at different semesters in their studies. Teachers are also part of the target audience since they will be the ones instructing students on how to use the tool, and thez can also use the tool themselves. Some of the students' specific characteristics are:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Pomodoro Technique tool are:

- Enhances student motivation and engagement.
- Develops essential skills such as self-management, adaptability, resilience and stress resistance.
- Provides a framework for students to perform their duties more efficiently.

Disadvantages of the Pomodoro Technique tool

- Flow disruption: The frequent breaks may interrupt the flow of work.
- Lack of flexibility: The rigid structure may not suit everyone's preferences, as some individuals may work more efficiently with longer focus periods or prefer different break intervals.
- Unsuitability for certain tasks: The Pomodoro Technique may not be suitable for tasks that require prolonged, uninterrupted concentration, such as in-depth research or complex report writing.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Pomodoro Technique tool can be adapted based on the specific needs and preferences of the students. Some possible variations include:

- **Extended Pomodoro:** This variation lengthens the work interval to 45 or 60 minutes with corresponding longer breaks, catering to tasks that require extended periods of focused work.
- **Short Pomodoro:** In contrast, the short Pomodoro shortens the work interval to 15 or 10 minutes, providing more frequent breaks and suitable for quick tasks.
- **Double Pomodoro:** This adaptation involves completing two consecutive work intervals without breaks, followed by a more extended break, beneficial for tasks needing prolonged focus or quick completion.
- **Flexible Pomodoro:** With this approach, individuals have the freedom to adjust work and break intervals based on their specific needs and task requirements.
- **Random Pomodoro:** Setting a random interval between 10 to 25 minutes for each work session adds an element of unpredictability to keep the mind engaged.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the quality of Pomodoro tool usage, the following methods can be considered:

- **Self-assessment:** Students can personally reflect on their obtained skills and progress – in written or oral form.
- **Goal progress tracking:** Students can track their progress in Pomodoro technique usage and present updates periodically – using predefined questionaries or by reports in free form.

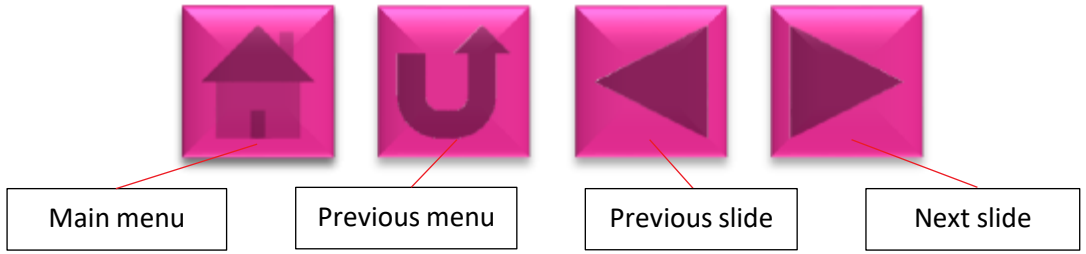
POMODORO TECHNIQUE *TOOL IS AVAILABLE AT THE – COPY ENTIRE FOLDER:*
https://drive.google.com/drive/folders/1itJGQ1gPFyDW_-GoQrzmSqx5fo4aser0?usp=sharing

GUIDE FOR EDUCATORS

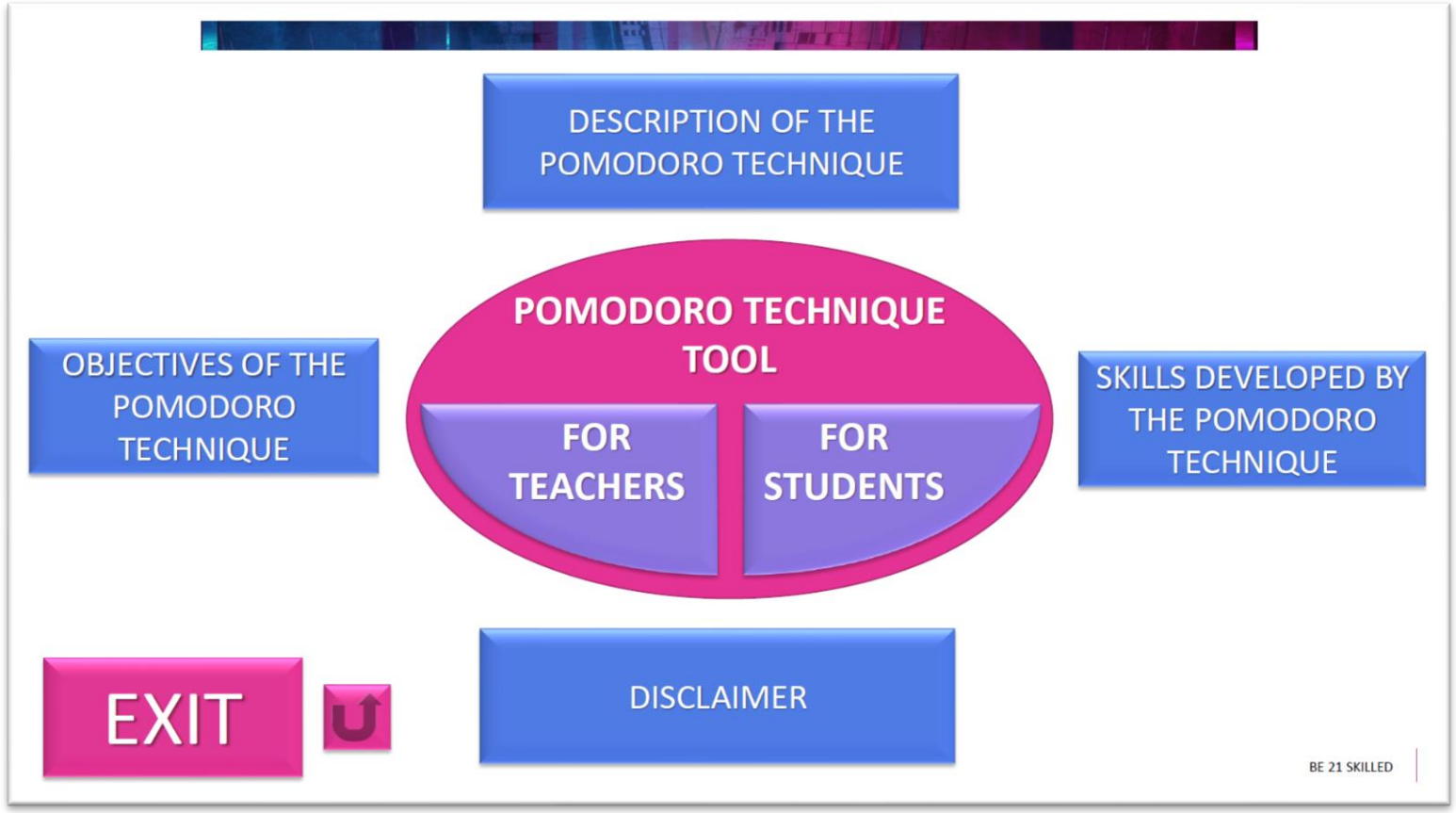
Instructions on how to use the Pomodoro Technique tool

START SCREEN:

To navigate the presentation, use the **NAVIGATION BUTTONS** at the bottom of the screen.



Pressing the **START** button opens the **MAIN MENU.**

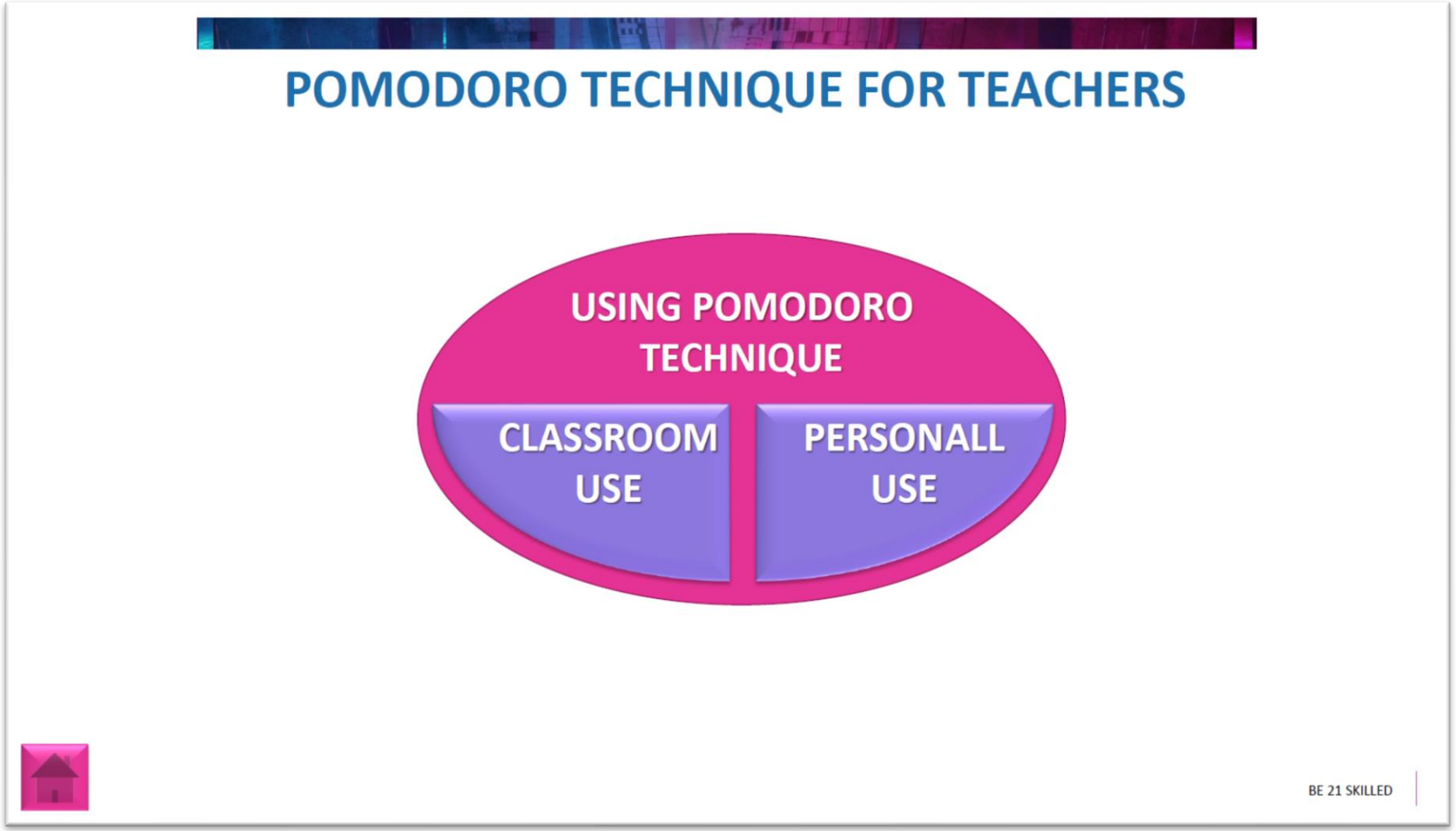


In the **MAIN MENU** you can press the following buttons:

1. **DESCRIPTION OF THE POMODORO TECHNIQUE**
2. **OBJECTIVES OF THE POMODORO TECHNIQUE**
3. **SKILLS DEVELOPED BY THE POMODORO TECHNIQUE**
4. **DISCLAIMER**

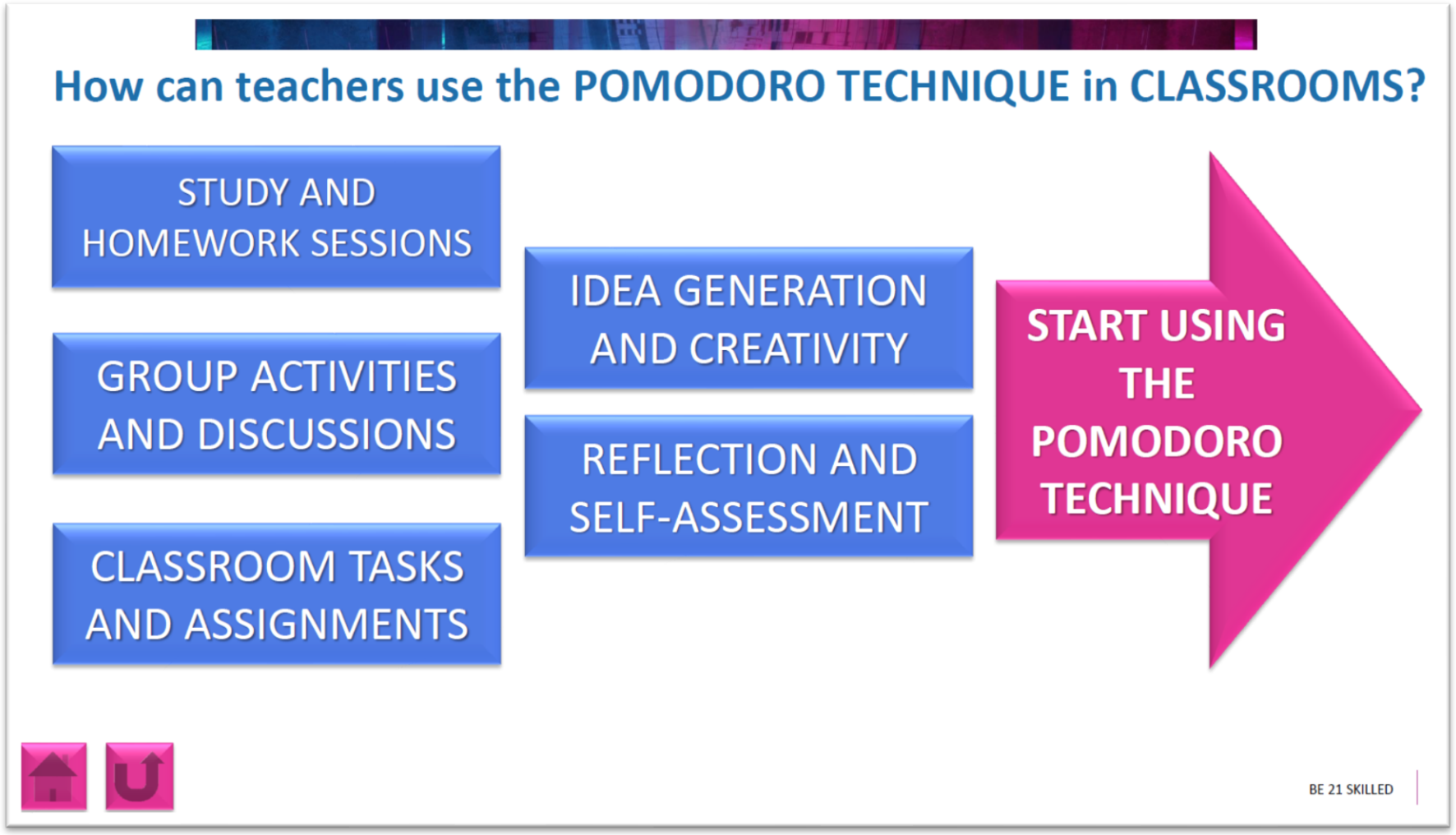
The central section of the **MAIN MENU** is divided in two parts: **FOR TEACHERS** and **FOR STUDENTS**.

When you press the '**FOR TEACHERS**' button in the **MAIN MENU**, the following menu opens:

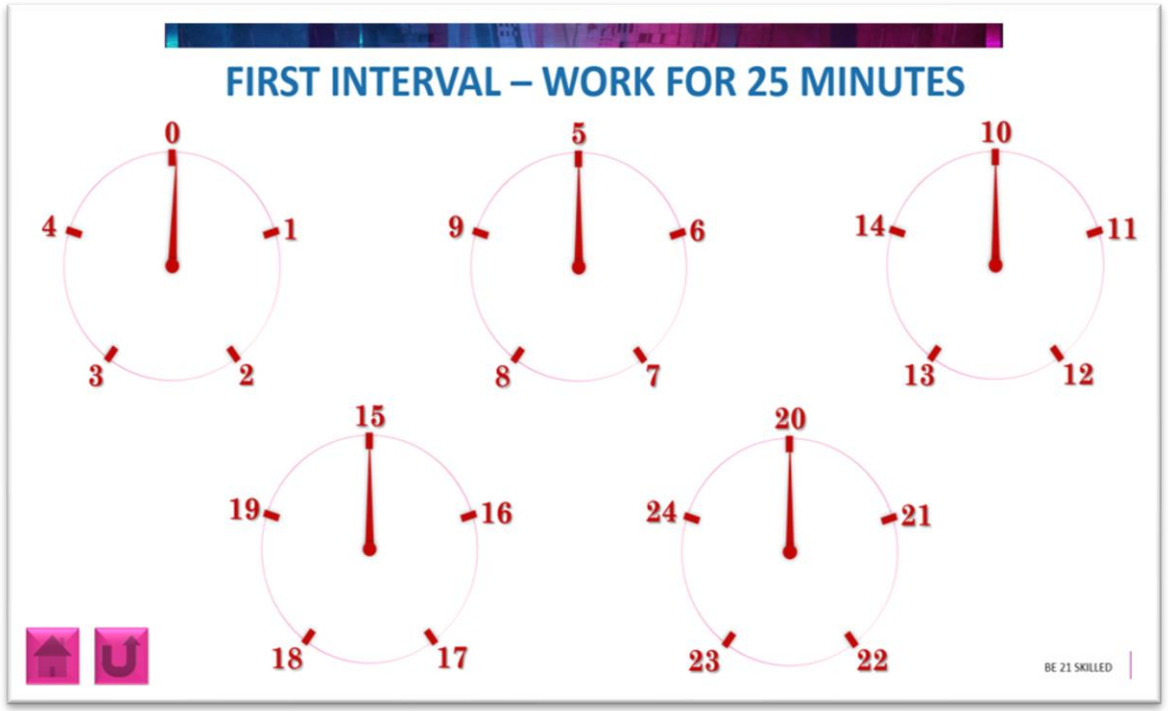


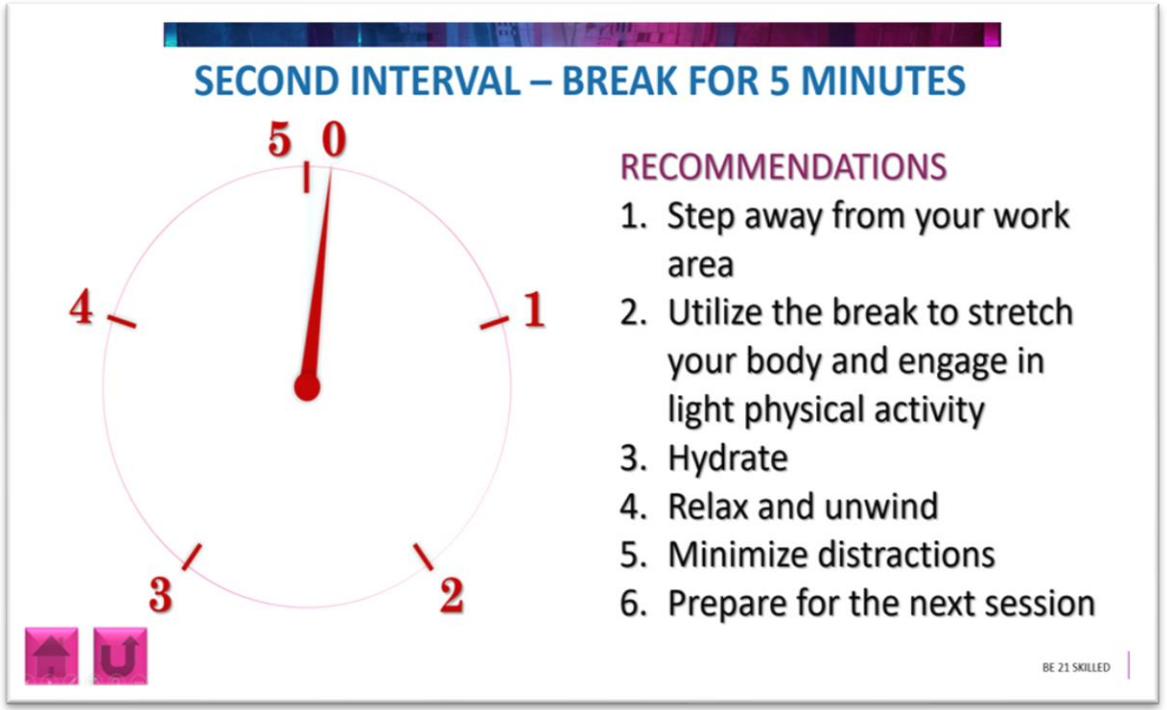
The central part of this menu is divided in two sections: **'CLASSOOM USE'** and **'PERSONAL USE'**.

When you press the **'CLASSROOM USE'** button, it leads to instructions for teachers on how to use the Pomodoro technique in classrooms. Each button leads to the description of a specific use of the Pomodoro technique.

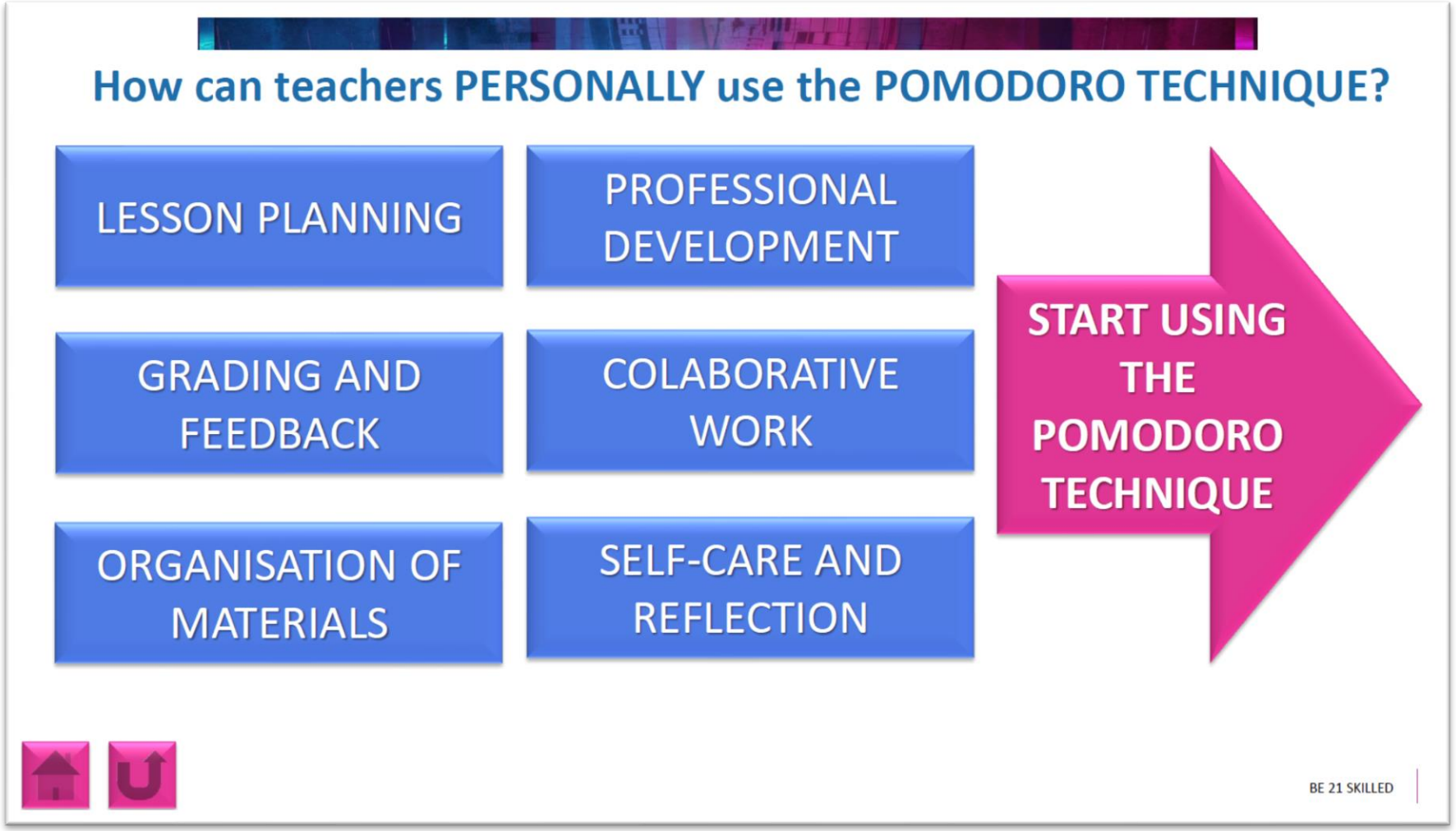


When you press the **'START USING THE POMODORO TECHNIQUE'** arrow button, it opens the automatic timer with instructions for 25-minute work intervals and 5-minute breaks

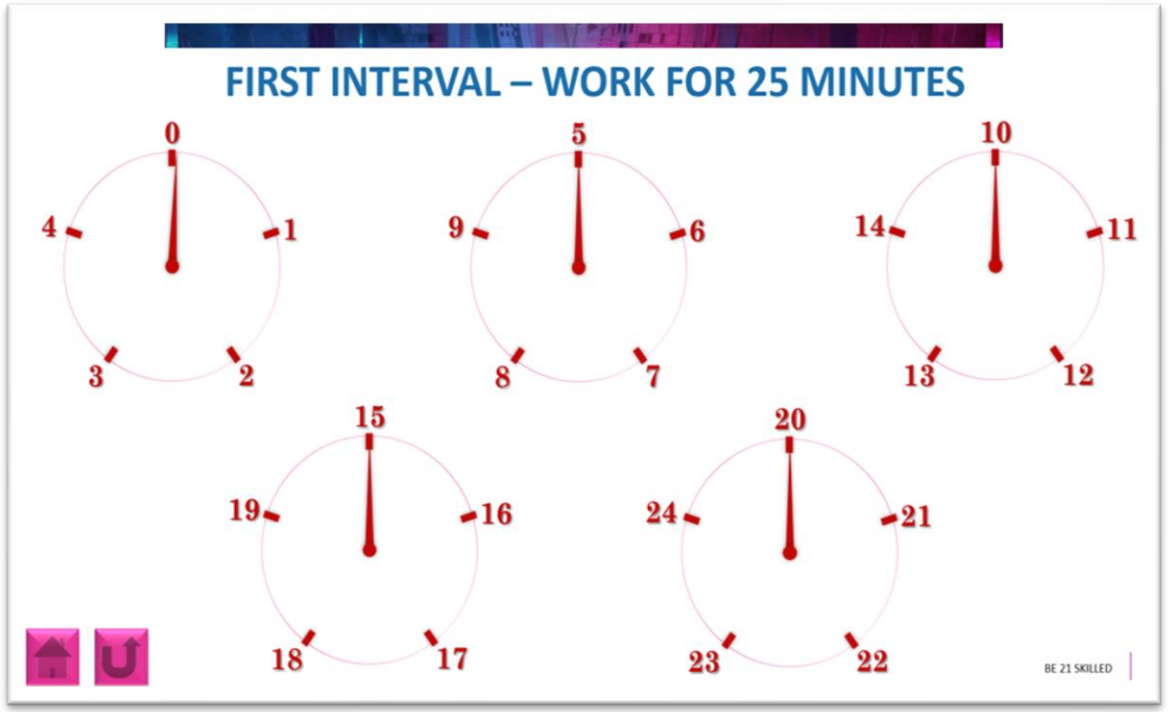


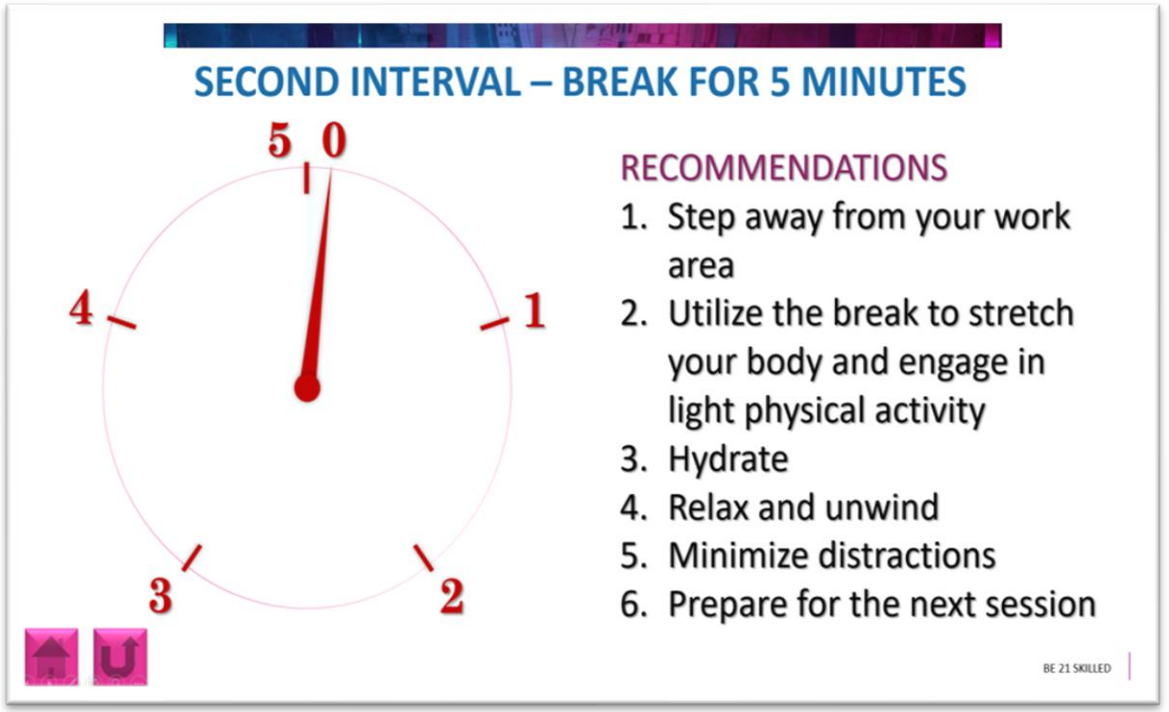


When you press the **'PERSONAL USE'** button in the **TEACHERS MENU**, it leads to instructions for teachers on how they can personally use the Pomodoro technique. Each button leads to the description of a specific use of the Pomodoro technique.

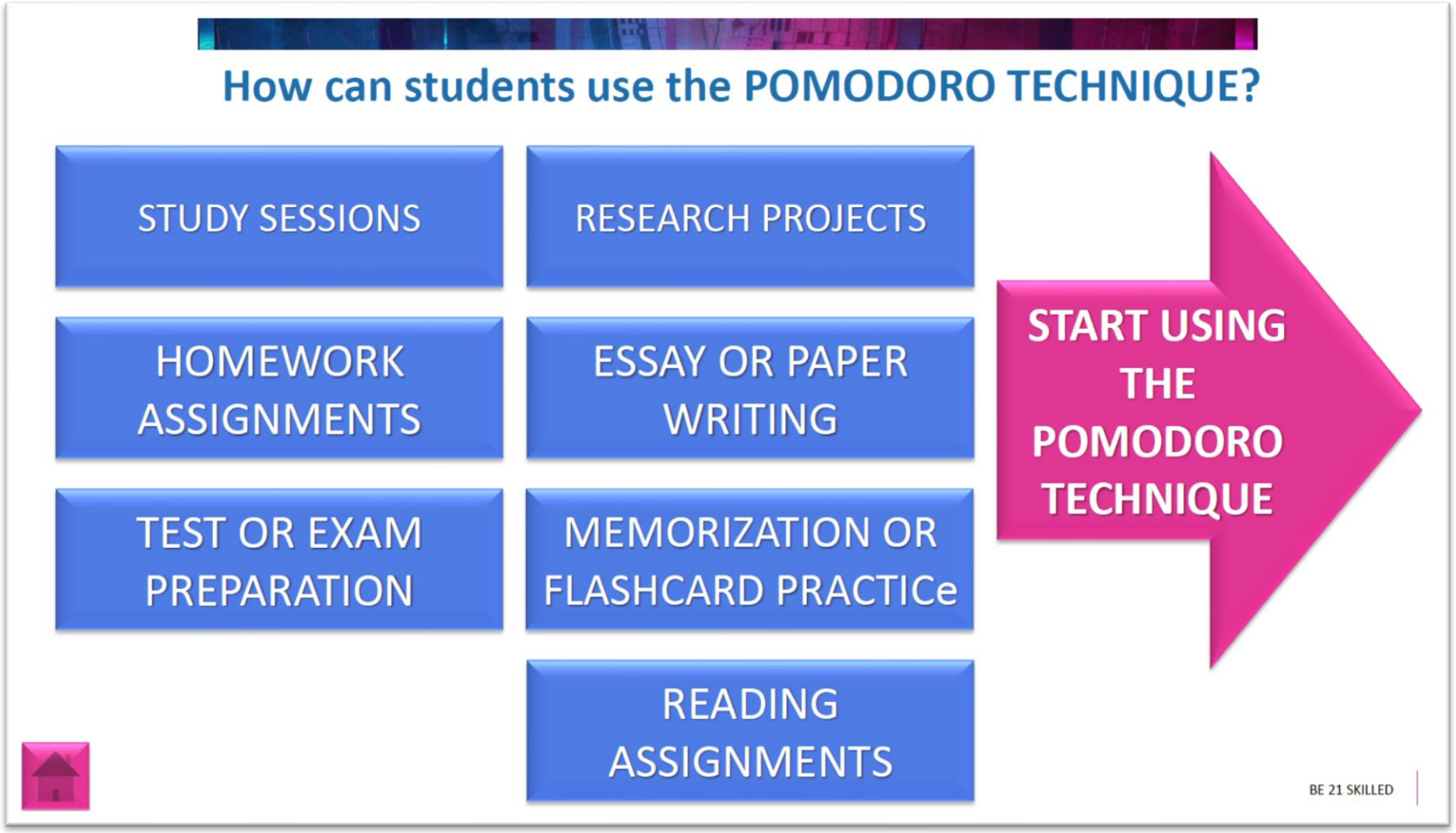


When you press the **'START USING THE POMODORO TECHNIQUE'** arrow button, it opens the automatic timer with instructions for 25-minute work intervals and 5-minute breaks:

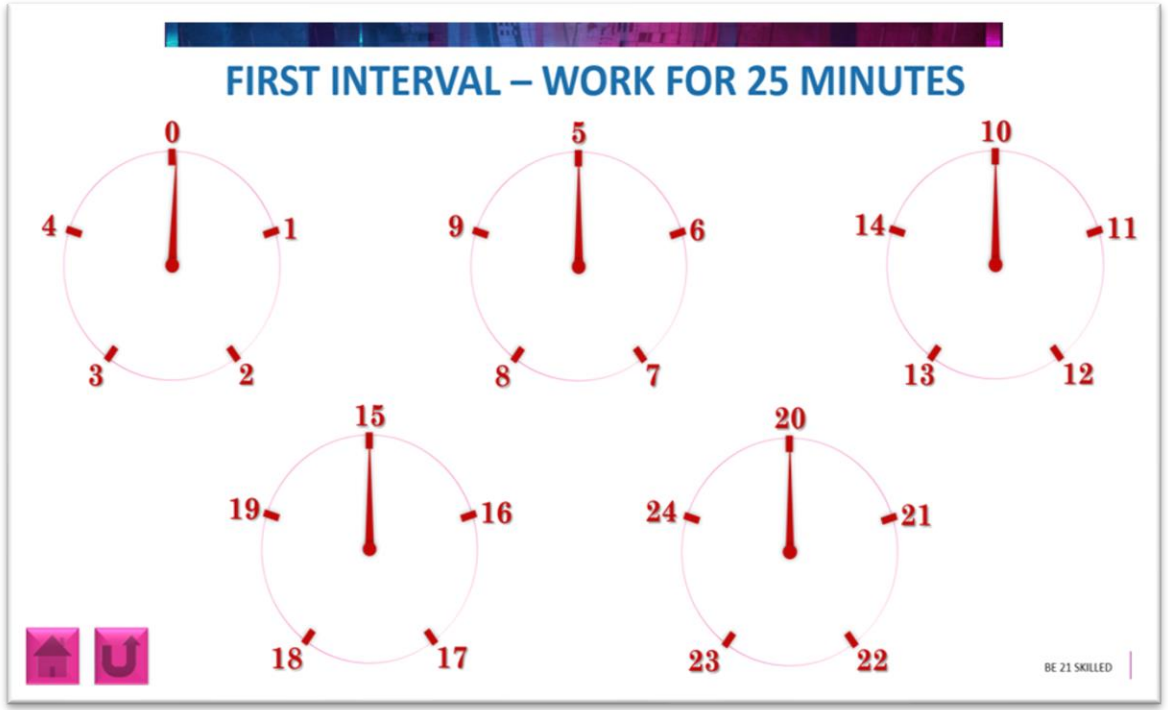


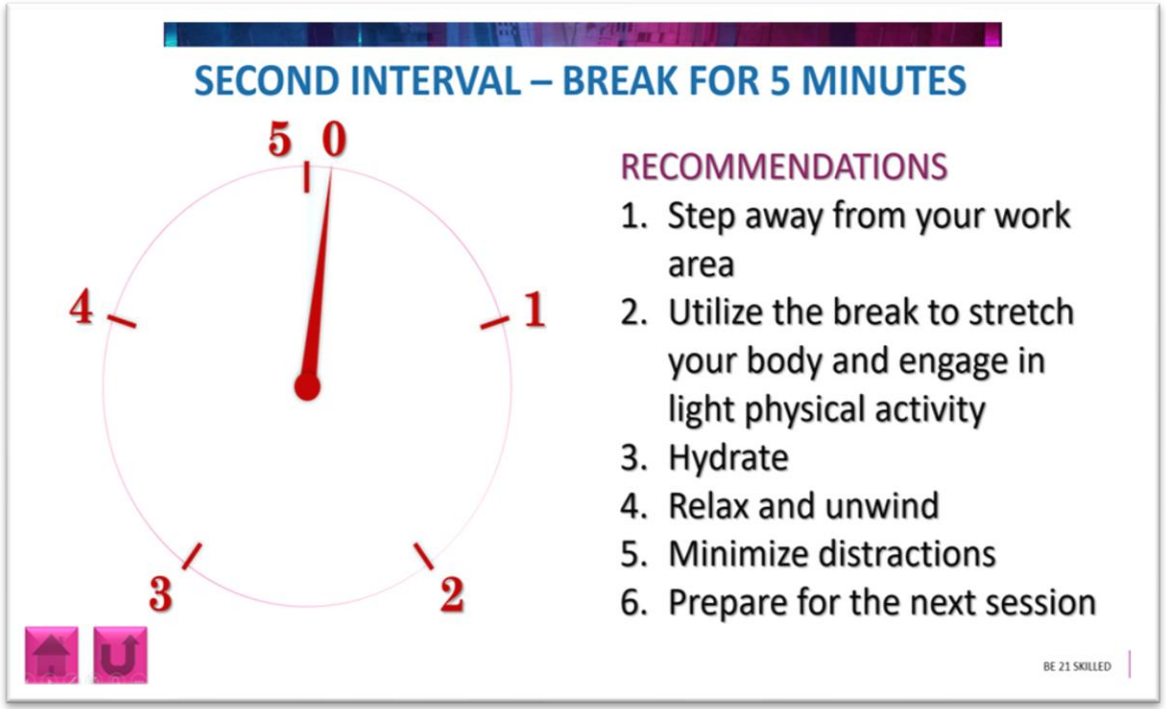


When you press the **'FOR STUDENTS'** button in the **MAIN MENU,** it leads to instructions for students on how they can personally use the Pomodoro technique. Each button leads to the description of a specific use of the Pomodoro technique.



When arrow button **START USING THE POMODORO TECHNIQUE** is pressed, it opens the automatic timer with instructions for 25-minute work intervals and 5-minute breaks:





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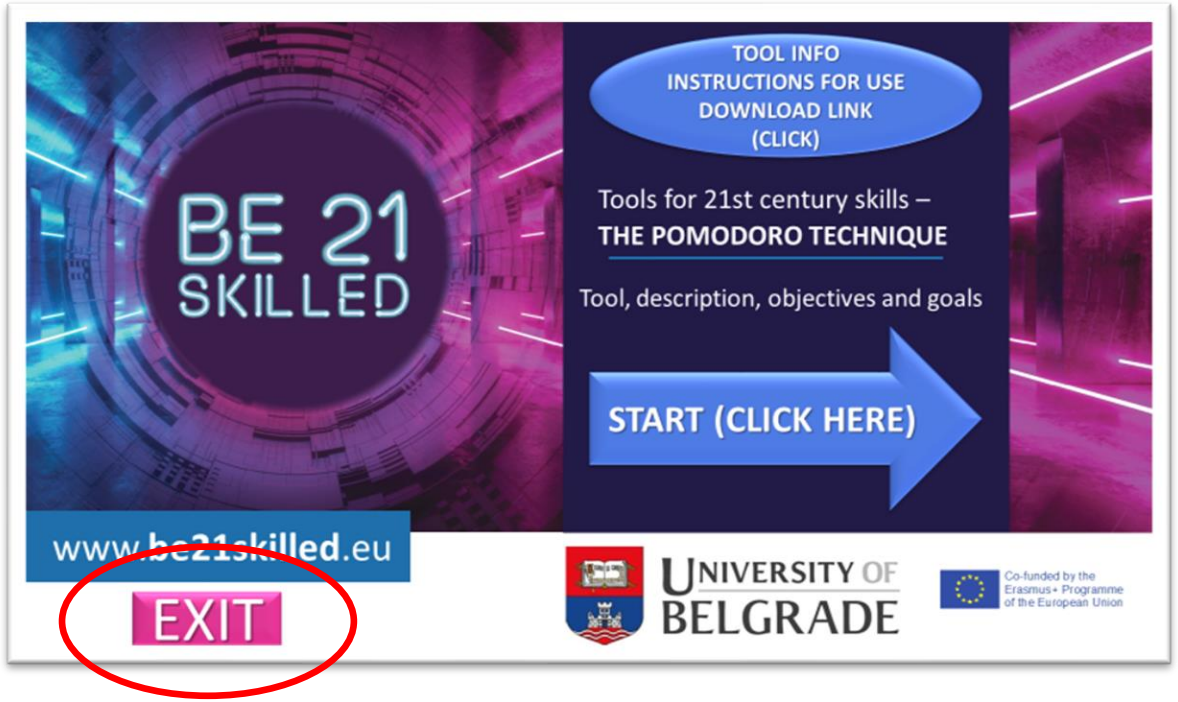
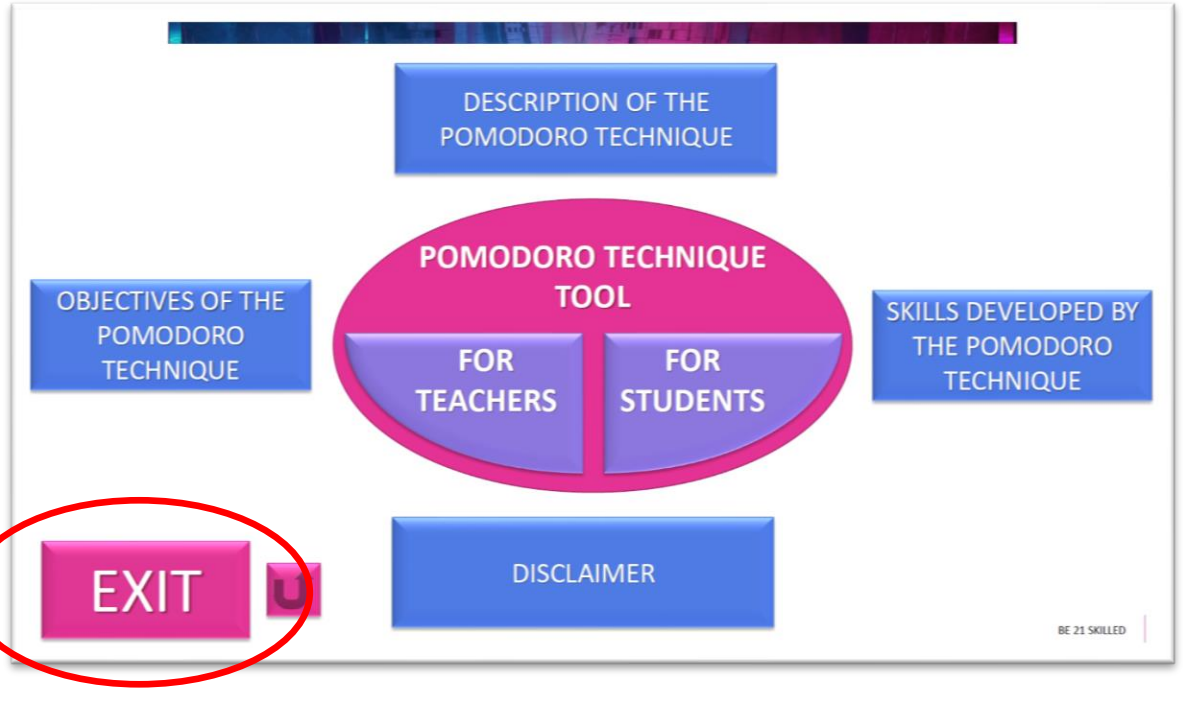




CREATIVITY, CURIOSITY, OPEN MINDSET, SPOTTING OPPORTUNITIES

05

05 | CREATIVITY, CURIOSITY, OPEN MINDSET, SPOTTING OPPORTUNITIES

This cluster involves a series of aptitudes, including creative thinking, curiosity, exploratory thinking, innovation, open mindset, originality, initiative, and the capability to spot opportunities (Līce, et al., 2023). The European Commission's Entrepreneurship Competence Framework (Bacigalupo, et al., 2016 as cited in Līce, et al., 2023) offers insight into these skills by stating that creativity involves generation of purpose-driven ideas. Individuals who cultivate creativity reveal a unique capacity to formulate multiple ideas and opportunities that hold the potential to create value, offering enhanced solutions to existing and emerging challenges.

On the other hand, the American Psychological Association (2023), defines curiosity as "the impulse or desire to investigate, observe, or gather information, particularly when the material is novel or interesting."

Regarding spotting opportunities, it is a skill that rests on imagination and adeptness, allowing individuals to discern prospects for value creation. This involves examining the social, cultural, and economic landscape to identify opportunities that align with needs and challenges awaiting resolution (Bacigalupo, et al., 2016 as cited in Līce, et al., 2023).

In the world of STEM, where new ideas move things forward, people who foster **creativity, curiosity, open-mindedness,** and **the ability to see opportunities** can help shape the future by coming up with fresh ideas, creative ways of doing things, and finding new possibilities that no one has thought about before.

TOOL DESCRIPTION + ITS RELEVANCE

Wonder Wall

The Wonder Wall is a living and interactive tool aimed at stimulating creativity, curiosity, and an open mindset. It encourages students to explore, question, and connect ideas, fostering opportunities for deep, personalised learning.

It is an essential tool for modern classrooms, empowering students to take ownership of their learning journey, igniting imagination, and cultivating a culture of inquiry and innovation.

Implementing the Wonder Wall involves creating an engaging space filled with prompts, artifacts, and stimuli that inspire curiosity and creativity. Students add their thoughts and questions, encouraging a dynamic and student-led exploration process guided by the teacher.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

How to Set Up the Wonder Wall

- **Create an Engaging Space:** Opt for a large, clear wall or even an interactive digital board accessible via tablets or laptops. Decorate it with themes relating to your current study topics to make it inviting.
- **Add Thoughts:** Here, variety is key. Use different coloured sticky notes, sketches, or multimedia attachments (for digital versions) to create a multi-sensory experience.
- **Teacher-Led Guidance:** Teachers not only supervise but also inject life into the space by adding challenges, inspiring quotes, or data snippets to stimulate discussion and thought.

When and How to Use the Wonder Wall

- At the start of a new term or STEM module, choose a visible wall or digital platform. Gather essential materials and set the wall up with prompts or questions to encourage initial engagement.
- During regular classroom hours, allow students to interact with the wall by adding their own questions, prompts, or insights, fostering a dynamic and student-led learning environment.
- Make it a weekly routine to introduce new prompts or challenges to the Wonder Wall to keep the engagement level high and sustain student interest.
- Incorporate a monthly review of the wall's content into your teaching schedule, using the gathered questions and ideas to inform and tailor upcoming lessons or activities.

LEARNING OUTCOMES

By using the Wonder Wall tool, students will be able to:

- Increase their creativity by gaining new approaches to solving problems innovatively.
- Enhance their curiosity by building a stronger inclination to explore topics outside the classroom.
- Benefit from a wider perspective through diverse questions and viewpoints, which will broaden their mindset.
- Develop the ability to see innovative or collaborative connections.
- Cultivate enduring skills like self-directed learning and critical thinking.

TEACHING METHODS USED

Integrating the Wonder Wall tool into STEM education not only enhances subject matter understanding but also enriches the teaching methods applied in the classroom. These methods aim to nurture both intellectual and emotional growth, resulting in a balanced and effective educational experience. Teaching methods include:

- **Work Together:** Bi-weekly group brainstorming sessions can be arranged to explore prevalent themes or hot topics on the Wonder Wall.
- **Think Back:** Monthly reflection sessions could be scheduled where students share their most interesting discoveries or challenging questions, fostering a shared learning experience.
- **Solve Real Problems:** For example, if the Wonder Wall has several questions about climate change, a project could be initiated to find feasible solutions using STEM knowledge.
- **Ongoing Help:** One-on-one or small group check-ins allow teachers to provide more tailored guidance and to help set achievable objectives based on individual interactions with the Wonder Wall.

SPECIFIC RESOURCES/ EQUIPMENT USED

- **Interactive Software**: Sophisticated virtual simulations can bring abstract STEM concepts to life, enhancing the Wonder Wall experience.
- **Videos and Podcasts:** Curated lists of documentaries or expert talks can deepen your understanding of Wonder Wall topics.
- **Online Platforms:** Tools like online forums or collaborative workspaces allow the class to extend the Wonder Wall discussions outside of school hours.

TARGET AUDIENCE (their characteristics and level)

The Wonder Wall is universally adaptable. For younger students, it could focus on basic scientific wonders like ‘Why is the sky blue?’, while for older students, it could contain complex equations or ethical dilemmas related to technology.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Wonder Wall include:

- Adaptability: The Wonder Wall is flexible enough to cater to various age groups and cognitive levels. For younger students, it might focus on fundamental queries like 'Why do magnets attract?', while for older students, it could delve into advanced theories or ethical considerations in science and technology.
- Goal-Oriented: Clear and achievable objectives can be set, making each interaction with the Wonder Wall a meaningful step towards personal and academic growth.
- High Engagement: Its interactive design fosters sustained enthusiasm and participation among students.

Disadvantages of the Wonder Wall include:

- Initial Setup: Creating the Wonder Wall requires thoughtful planning and resource allocation, which may be time-consuming.
- Ongoing Maintenance: The effectiveness of the Wonder Wall depends on regular updates, contributions, and engagement from both students and teachers.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

- **Digital Version:** Great for remote learning, you can set up a digital Wonder Wall on platforms like Padlet.
- **Do It Yourself:** You could even have a mini Wonder Wall at home, dedicated to your personal interests or hobbies.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

It is not just about what is visible on the wall. Teachers will monitor students' ability to ask deeper questions over time, their eagerness to explore, and even how they help peers on their learning journey. This can be done through:

- Mini quizzes,
- project work,
- or even simple discussions.

GUIDE FOR EDUCATORS

Steps for Integrating the Pyramid Team Building Tool into STEM Education

01 | Research and Discovery

- Introduce all involved educators to participate in a Wonderwall Activity
- This means the educators will be able to see the benefits Wonderwalls for themselves!

02 | Selection and curation

- Once the educators have witnessed the effects and benefits of Wonderwalls, they can decide on when they would like to use and the nature of its implementation in their classroom. Prepare a question related to the given STEM subject which you can pose to the students.

03 | Lesson integration

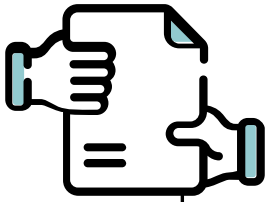
- Plan a lesson or module around the activity.
- Make sure to have the necessary equipment (interactive software, podcasts, selected online platform)

04 | Student engagement

- Once you have decided how the students will interact with the Wonderwall, show the class the example of when you are your colleagues tried the activity, easing them into this new way of addressing questions, which will encourage open mindsets throughout the cohort.

06 | Project assignment

•Set up a Wonder Wall with STEM prompts at the term's start, encourage daily student interaction, refresh it weekly, and review monthly to guide upcoming lessons.



07 | Review and feedback

•Have a brief chat after the activity to gauge students' understanding and thoughts on creativity and curiosity.
•Feedback Surveys or Essays. Hand out short questionnaires or assign quick reflection tasks to measure the activity's impact.
•Peer Review with Educators. Talk to fellow teachers who've used the activity to discuss its effectiveness and possible improvements.

08 | Iterate and Enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.

TOOL DESCRIPTION + ITS RELEVANCE

AIFUSE Technique

Using the AIFUSE Technique, STEM students will be better equipped to integrate, understand, and innovate within a future that's increasingly intertwined with artificial intelligence.

The AIFUSE technique is adapted from the SCAMPER technique which stands for: Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse. The SCAMPER method is very similar to Design Thinking as both concepts aim to find solutions to problems. However, Design Thinking places the human factor at the centre and its goal is to find creative ways to solve problems. In contrast, the SCAMPER technique is more focused on the process of finding unusual and creative solutions to problems, but also to come up with innovative ideas, and the goal of improving a product or service.

We have developed a new technique known as the AIFUSE technique, which serves as a brainstorming tool used to develop new ideas or products by encouraging students to think about existing concepts from new perspectives. We understand that our students, as well as the future STEM workforce, will face novel challenges and evolving technologies, making the ability to repurpose, innovate, and think outside the box critical. However, in a world dominated by AI, there's a need to look at traditional concepts through a new lens.

The AIFUSE technique encourages students to think about existing technologies and methodologies in the context of AI-powered futures.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The technique can be integrated into teaching by

- Using it during sessions on futuristic thinking, AI modelling, or when encouraging students to innovate beyond traditional STEM scopes.
- Encouraging students to apply each AIFUSE element to AI-driven scenarios or problems.

LEARNING OUTCOMES

By using the AIFUSE technique tool, students will:

- Increase understanding of AI integration into traditional STEM fields.
- Enhance innovative thinking tailored to AI-powered futures.
- Develop skills in adapting and rethinking solutions with AI.

TEACHING METHODS USED

To implement the AIFUSE technique effectively, the following teaching methods can be used:

- AI simulation exercises.
- Collaborative brainstorming sessions.
- Hands-on coding or prototyping activities

SPECIFIC RESOURCES/EQUIPMENT USED

- AI simulation software. Examples are TensorFlow with TensorBoard which offer a practical and visual platform for students to innovate, iterate, and fuse AI concepts within STEM disciplines, fully embodying the principles of the AIFUSE approach.
- Brainstorming boards or digital platforms.
- Access to AI datasets or learning modules.

TARGET AUDIENCE (their characteristics and level)

The target audience will be

- STEM students of various programs and at different semesters in their studies with a basic knowledge of AI.
- Those interested in future tech and innovation.
- Educators looking to integrate AI-centric thinking in STEM education.

ADVANTAGES + DISADVANTAGES OF THE TOOL

The advancement of technology in education, particularly AI, has been met with a mix of enthusiasm and scepticism. To address the scepticism of educators, it's crucial to demystify the processes and applications of AI. Teachers need concrete evidence of AI's effectiveness in the context of STEM teaching, enhancing learning experiences, rather than replacing the human touch in education. Offering training sessions, workshops, and firsthand experiences with AI tools can shift perceptions.

Moreover, to build trust, AI in education should be transparent, ethical, and designed to support, rather than replace, the educator's role. The trustworthy element in AI comes from its consistency, its data privacy assurances, and its ability to adapt to individual student needs without bias. By ensuring educators understand and are involved in the AI integration process, their scepticism can be transformed into a collaborative embrace of this powerful tool. We recommend teachers to use the open access resources of the **ERASMUS+ Trustworthy AI project** and the **Framework for Trustworthy AI Education.**

Advantages of the AIFUSE model include

- Forward-thinking and tailored to the AI-dominated future.
- Encourages a multidisciplinary approach.
- Boosts AI literacy alongside STEM concepts.

Disadvantages include

- Might require foundational AI knowledge.
- Need to increase trust in AI and empower students to use it in a very progressive way
- Needs resources like AI software or datasets.
- Might be challenging for those unfamiliar with AI.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Some ideas on possible adaptations of the EdSurge tool include:

- AIFUSE Challenges: Monthly competitions where students tackle global problems using the technique.
- Interdisciplinary Workshops: Merge non-STEM fields (like arts) to encourage broader applications

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **AI Insight Assessment:** Evaluate the feasibility and depth of AI-focused ideas generated by students. This will gauge their understanding of how AI can be applied to a particular problem or challenge.
- **Prototyping and Modelling**: Encourage students to create AI models or prototypes based on AIFUSE concepts. Their ability to transform theoretical ideas into tangible models will be a significant indicator of their skill acquisition.
- **Organize group discussions and reflections** about their experience using the AIFUSE method. Encourage students to share what worked for them, what they found challenging, and how they might use this process in the future.
- **Promote continual iteration**, where students have the opportunity to improve upon or build on their peers' AI ideas. By doing so, they can learn the value of feedback and refinement in the innovation process.
- **Introduce peer review sessions** where students evaluate each other's work using the AIFUSE methodology. Peer insights can offer diverse perspectives and promote further understanding.

GUIDE FOR EDUCATORS - AIFUSE Technique, step-by-step

01 ANALYSE

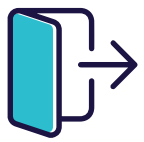
Begin by assessing the current STEM problem or topic. Understand its intricacies and challenges.

02 IDENTIFY

Pinpoint specific areas where AI can be applied. Look for gaps, inefficiencies, or places where predictions and automation might be beneficial.

03 FUSE

Integrate AI tools, algorithms, or methodologies into the identified STEM areas. This step requires creativity and innovation.



04 UNDERSTAND

Deepen the comprehension of how AI interacts with the STEM concept. Consider the advantages, potential pitfalls, and the broader implications.

05 SOLVE

Apply the integrated AI solution to the STEM problem. Evaluate the results, compare with traditional methods, and optimize further if needed.

06 EVALUATE

Always reassess and refine. AI and STEM are evolving fields, and the fusion of both should be regularly revisited for optimal results

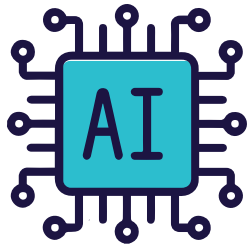
GUIDE FOR TEACHERS

Integrating the AIFUSE TECHNIQUE into STEM Education

The integration of AIFUSE into STEM is not just about teaching students a new technique. It's about reshaping their perspective on problem-solving in a world increasingly driven by artificial intelligence.

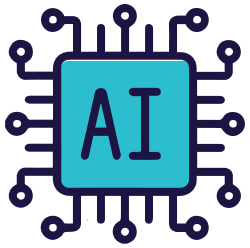
Here's a step-by-step guide to it application in STEM education :

01 | Lay a strong foundation for AI, explaining its significance and potential impact in STEM.



- **AI Orientation:** Refer to ERASMUS+ Trustworthy AI project https://www.trustworthyaiproject.eu / and the Framework for Trustworthy AI Education Framework for Trustworthy AI Education
- Conduct sessions that shed light on the history, foundational principles, current applications, and future trajectories of AI. This might include showing documentaries, guest lectures, or interactive e-learning modules.
- **Brainstorming Sessions:** Encourage students to discuss their preconceptions and understanding of AI, fostering a classroom environment of curiosity and inquiry.

01 | Lay a strong foundation for AI, explaining its significance and potential impact in STEM.



- **Real-world Impact:** Discuss STEM industries and breakthroughs where AI has made a mark. For instance,
  - **Construction and Urban Planning:**
    Smart Cities: AI is being used to develop solutions for traffic congestion, energy consumption, and waste management in urban environments.
    Construction Safety: Using AI, drones can monitor construction sites, ensuring that safety protocols are being followed.
  - **Manufacturing:**
    Quality Control: AI-driven robotic arms equipped with cameras can inspect products on assembly lines with high precision.
    Supply Chain Optimization: Using AI to predict which goods and materials will be in demand can streamline production processes.
  - **Automotive Industry:**
    Autonomous Vehicles: Self-driving cars use AI to interpret data from vehicle sensors and make split-second decisions that can help avoid accidents and navigate the road.

02 | Analyzing STEM Concepts: Deep dive into STEM subjects, exploring potential intersections with AI.

- **Choosing the Topic:** Initiate with a familiar STEM topic to you that has clear applications or components that can be enhanced or transformed by AI, some ideas to inspire you from across STEM

  - **Science: Genetic Sequencing**
    AI Application: AI algorithms can be used to analyze and interpret vast amounts of genetic data at an accelerated pace. This can help identify patterns related to genetic disorders or ancestral information. In research settings, machine learning models can predict how genes can cause certain diseases or even predict an individual's response to drugs based on their genetic makeup.
  - **Technology: Information Retrieval (like search engines)**
    AI Application: Machine learning models power modern search engines, helping to refine search results based on user behavior. Natural Language Processing (NLP), a subfield of AI, can be utilized to understand and generate human language, making search queries more intuitive and the results more relevant.

02 | Analyzing STEM Concepts: Deep dive into STEM subjects, exploring potential intersections with AI.

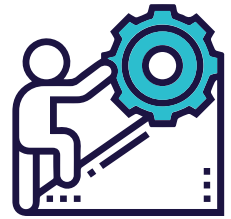
- **Engineering: Robotics**
  AI Application: While robotics deals with the creation and design of robots, AI provides the "brains" or intelligence for these robots. This allows robots to navigate complex environments, recognize and manipulate objects, or even interact with humans in a collaborative manner. For instance, AI-powered robots are now being used in warehouses to pick and pack items, in hospitals to assist in surgeries, or in homes as companions.
- **Mathematics: Data Analytics**
  AI Application: Machine learning models thrive on data. Data analytics, when combined with AI, can reveal patterns, anomalies, or trends that might be invisible to the naked eye. For instance, in finance, AI-powered data analytics can predict stock market trends. In e-commerce, it can help understand customer behavior to provide product recommendations.

02 | Analyzing STEM Concepts: Deep dive into STEM subjects, exploring potential intersections with AI.

- **Deconstruct the Topic:** Break the chosen subject into its fundamentals. What are the underlying principles, methodologies, and challenges inherent in it? Perhaps use AI simulation software. Examples are TensorFlow with TensorBoard Get started with TensorBoard | TensorFlow which offer a practical and visual platform for students to innovate, iterate, and fuse AI concepts within STEM disciplines, fully embodying the principles of the AIFUSE approach. TensorFlow offers hands-on experience in model development, while TensorBoard aids in the visualization and optimization of the AI processes. Students can see the cause and effect of adjustments in real-time, enhancing their learning experience.
- **Spotting AI Opportunities:** Encourage students to think about areas where AI could assist, enhance, or revolutionize these foundational elements.

TensorFlow is an open-source AI framework developed by Google. It allows users to design, train, and deploy machine learning models. TensorBoard, its visualization tool, enables the visualization of complex model structures, making the understanding and interpretation of AI models more transparent and intuitive.

03 | Introducing the AIFUSE Technique Steps



Acquaint students with the step-by-step procedure of AIFUSE.

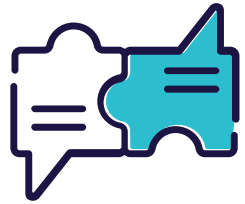
- Visual Presentation Use diagrams, flowcharts, or animations to walk students through the AIFUSE pathway. Use our PowerPoint example.
- **Detailed Explanation. Elaborate on each segment:**
  - Analyze: Understanding the intricacies of a STEM problem.
  - Identify: Recognizing areas ripe for AI integration.
  - Fuse: Merging AI tools/techniques to address those areas.
  - Understand: Grasping the implications, both positive and negative, of that integration.
  - Solve: Explore deploying the AI-infused solution in real-world scenarios.
- **Q&A Rounds:** After explaining each step, hold Q&A sessions, clearing doubts and reinforcing understanding.

04 | Practical Application

Translate theoretical knowledge into actionable insights and solutions.

- Classroom exercise/group dynamics: Divide students into groups, ensuring a mix of expertise and backgrounds, fostering interdisciplinary thinking.
- Choosing a Topic: Either assign a STEM challenge or allow groups to pick one, ensuring it's ripe for AI integration.
- Mentorship and Monitoring: As students work through the AIFUSE steps, provide guidance, resources, and feedback. This could be in the form of weekly check-ins, providing AI tools, or connecting them with industry professionals.
- Showcase and Review: Organize presentations where groups showcase their solutions, allowing peer review and feedback.

05 | Reflection and Feedback



Gauge the success of the AIFUSE implementation and iterate for improvement.

- Feedback Sessions Organize structured sessions where students can offer feedback on the AIFUSE methodology, its relevance, and its effectiveness.
- Encourage Self-reflection: Encourage students to document or create vlogs about their AIFUSE technique experience focusing on their learnings, challenges, and achievements.
- Iterative Approach: Based on feedback, adapt and modify the teaching strategy, ensuring it remains student-centric.

For this tool to be effective it is vital to stay abreast of the rapid developments in the AI field.

06 | Continuous Learning

some ideas

- Continuous Professional Development (CPD): Regularly attend workshops, webinars, or conferences on AI advancements and pedagogical techniques.
- Curriculum Integration: As AI evolves, update the curriculum to incorporate new tools, techniques, or ethical considerations.
- Student-led Initiatives: Encourage students to lead clubs, workshops, or projects centered on trustworthy AI, fostering a culture of peer-led learning

TOOL DESCRIPTION + ITS RELEVANCE

POSITIVE ATTITUDE TOOL

"A positive attitude is a mindset that embraces optimism, hopefulness, and a constructive perspective on life, even amidst challenges."

A positive attitude involves focusing on the potential for growth and positive outcomes, appreciating life's blessings, and displaying resilience in the face of adversity.

A positive attitude nurtures a mentality of abundance, gratitude, and courage, allowing individuals to flourish, overcome obstacles, and build supportive relationships.

Developing a positive attitude requires care, cultivation, and mindfulness. It is not about denying challenges or negative emotions, but about choosing to approach life with hope and a constructive mindset.

A positive attitude serves as a guiding compass, illuminating the path through life's ups and downs, empowering individuals to embrace opportunities and create a brighter, more resilient world.

Beside the positive attitude, this tool can be used to improve the following skills: creativity, curiosity, open mindset, spotting opportunities.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The Positive Attitude tool can be used in classrooms at any time during the semester to enhance students' attitude, creativity, curiosity, open mindset as well as spotting opportunities.

LEARNING OUTCOMES

By using the Positive Attitude Improvement tool, students will be able to:

- Cultivate enhanced overall well-being, leading to increased happiness, contentment, and overall life satisfaction.
- Develop resilience, enabling individuals to rebound from setbacks, challenges, and adversity with increased determination and strength.
- Manage stress more effectively, resulting in improved mental and emotional well-being.
- Foster a constructive mindset, empowering individuals to approach problems and challenges with optimism and creativity, leading to more effective and innovative solutions.
- Achieve increased productivity, focus, and efficiency in academic and professional endeavours through the development of a positive attitude.
- Optimise academic and professional performance by fostering a proactive and optimistic approach to challenges and tasks.

TEACHING METHODS USED

To implement the Positive Attitude Improvement tool effectively, the following teaching methods can be used:

- **Interactive presentation:** it helps introducing the concept and improvement of the Positive Attitude.
- Learning from **inspirational stories and anecdotes** about famous personalities.
- Improving attitude by **listening to motivational music/videos.**
- Improving attitude by **visits to relaxing websites.**

SPECIFIC RESOURCES/ EQUIPMENT USED

- Personal computer or laptop
- Video projector (optional)
- Speakers (optional)

TARGET AUDIENCE (their characteristics and level)

The target audience are STEM students of various programs and at different semesters in their studies. Teachers are also part of the target audience since they will be the ones instructing students on how to use the tool. Some of the students' specific characteristics are:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Positive Attitude tool:

- It improves motivation and engagement, resulting in enhanced academic performance and achievements.
- It fosters students' communication and social skills, leading to better relationships with teachers and peers.
- Students exhibit fewer disciplinary problems and disruptive behaviour, resulting in a more focused learning environment.

Disadvantages of the Positive Attitude tool:

- The training might place too much emphasis on individual attitudes, potentially overlooking external factors and systemic issues influencing students' experiences.
- A strong focus on positivity could overshadow the need to address students' emotional well-being and process negative emotions.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Positive Attitude tool can be adapted based on the specific needs and preferences of the students. Some possible variations include:

- **Leadership Positive Attitude Training:** This training helps students develop a positive leadership style that inspires and motivates their team members effectively.
- **Positive Attitude Stress Management Training:** This variation focuses on equipping participants with coping strategies to maintain a positive attitude in high-stress environments.
- **Positive Attitude Team-Building Training:** Geared towards teams, this training aims to improve teamwork, cooperation, and a positive team spirit.
- **Community Positive Attitude Training:** This variation aims to foster a positive attitude within community settings, promoting cooperation, support, and positive interactions among community members.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the quality of Positive Attitude Improvement tool usage, the following methods can be considered:

- **Self-assessment:** Students can personally reflect on the progress of the skills they obtained (positive attitude, creativity, curiosity, open mindset, spotting opportunities) – in written or oral form.
- **Goal progress tracking:** Students can track their progress and present updates periodically – using predefined questionaries or by reports in free form.

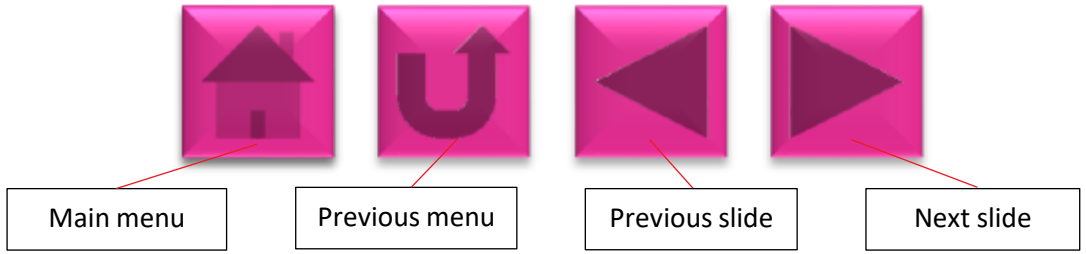
POSITIVE ATTITUDE *TOOL IS AVAILABLE AT THE – COPY ENTIRE FOLDER:*
https://drive.google.com/drive/folders/1C-xDCPDUkqWIvtQ3XlgP_qdjaPmsmt0L?usp=sharing

GUIDE FOR EDUCATORS

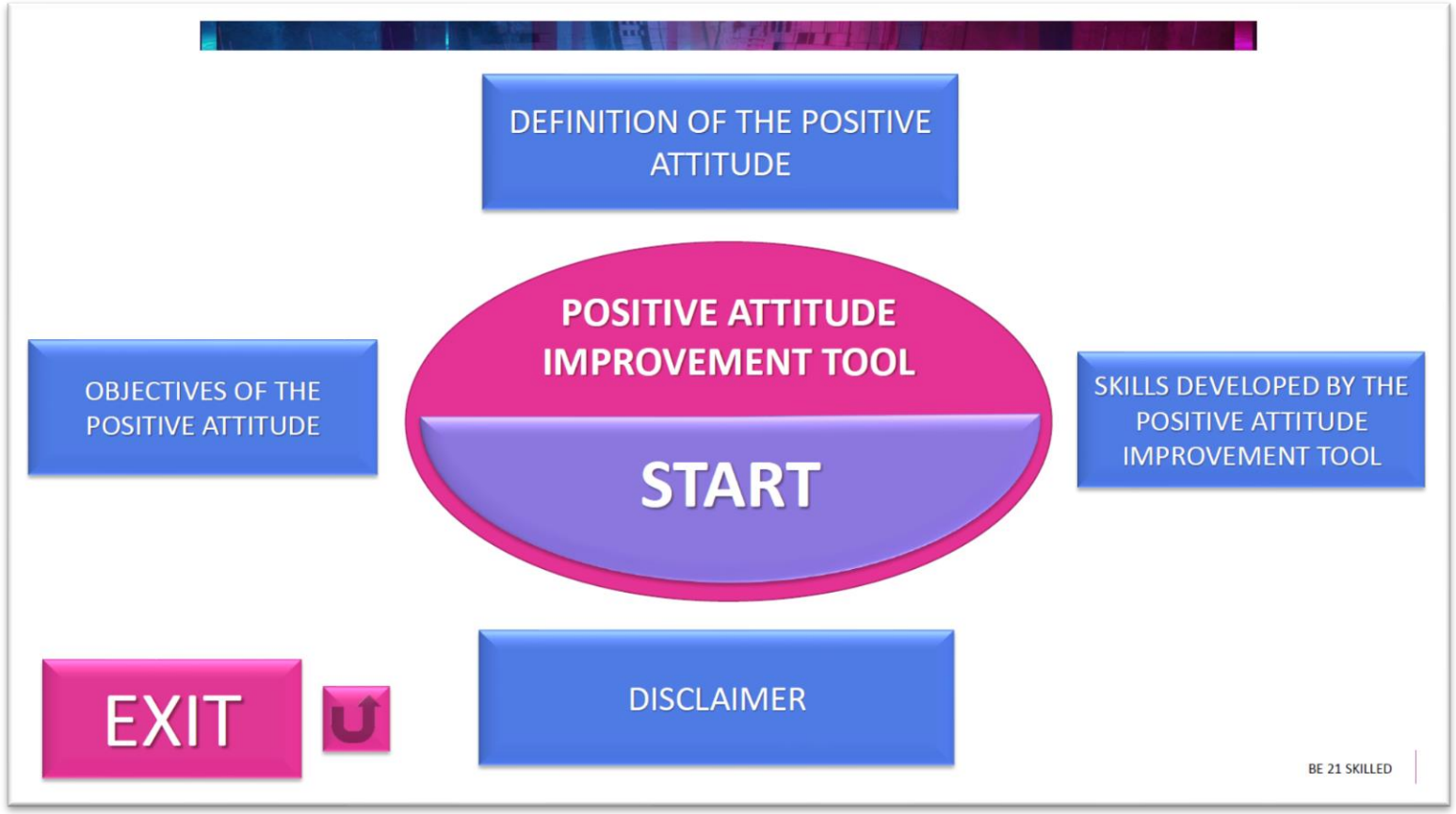
Instructions on how to use the Positive Attitude tool

START SCREEN:

For navigation through the presentation, **NAVIGATION BUTTONS** at the screen bottom are used:



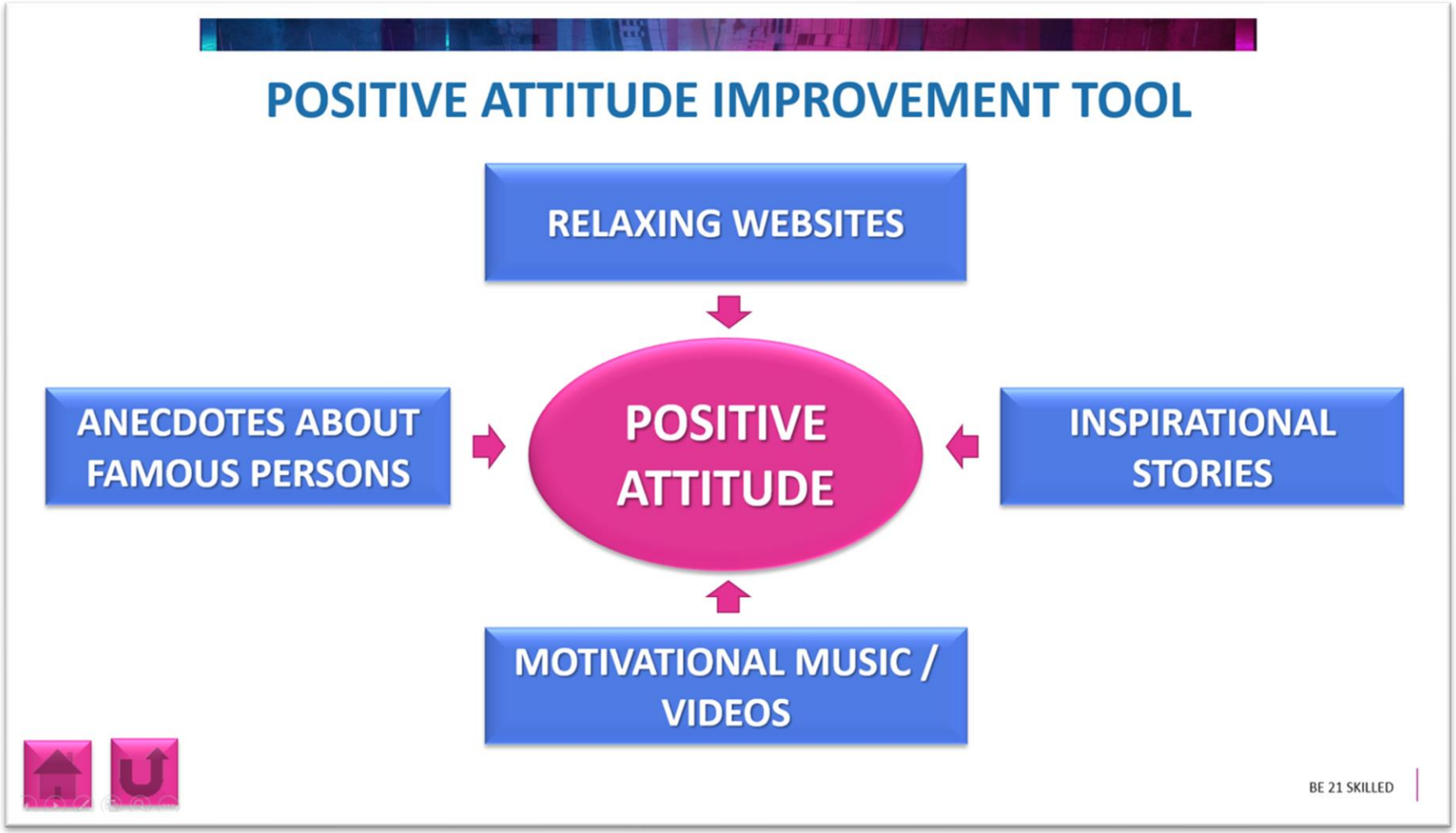
After the **START** button is pressed, the **MAIN MENU** opens:



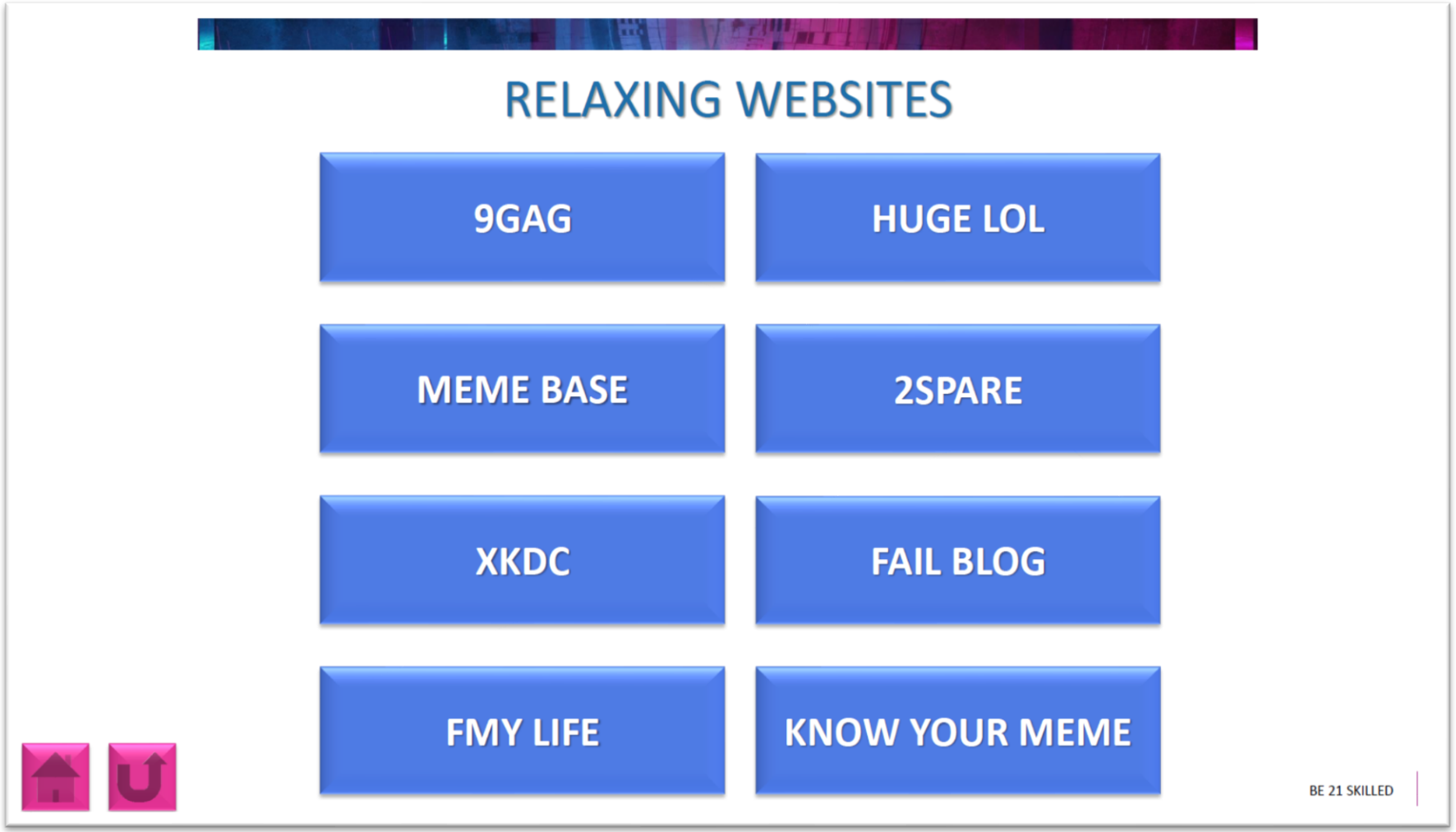
In the **MAIN MENU** the following buttons can be pressed:

1. **DEFINITION OF THE POSITIVE ATTITUDE**
2. **OBJECTIVES OF THE POSITIVE ATTITUDE IMPROVEMENT TOOL**
3. **SKILLS DEVELOPED BY THE POSITIVE ATTITUDE IMPROVEMENT TOOL**
4. **DISCLAIMER**

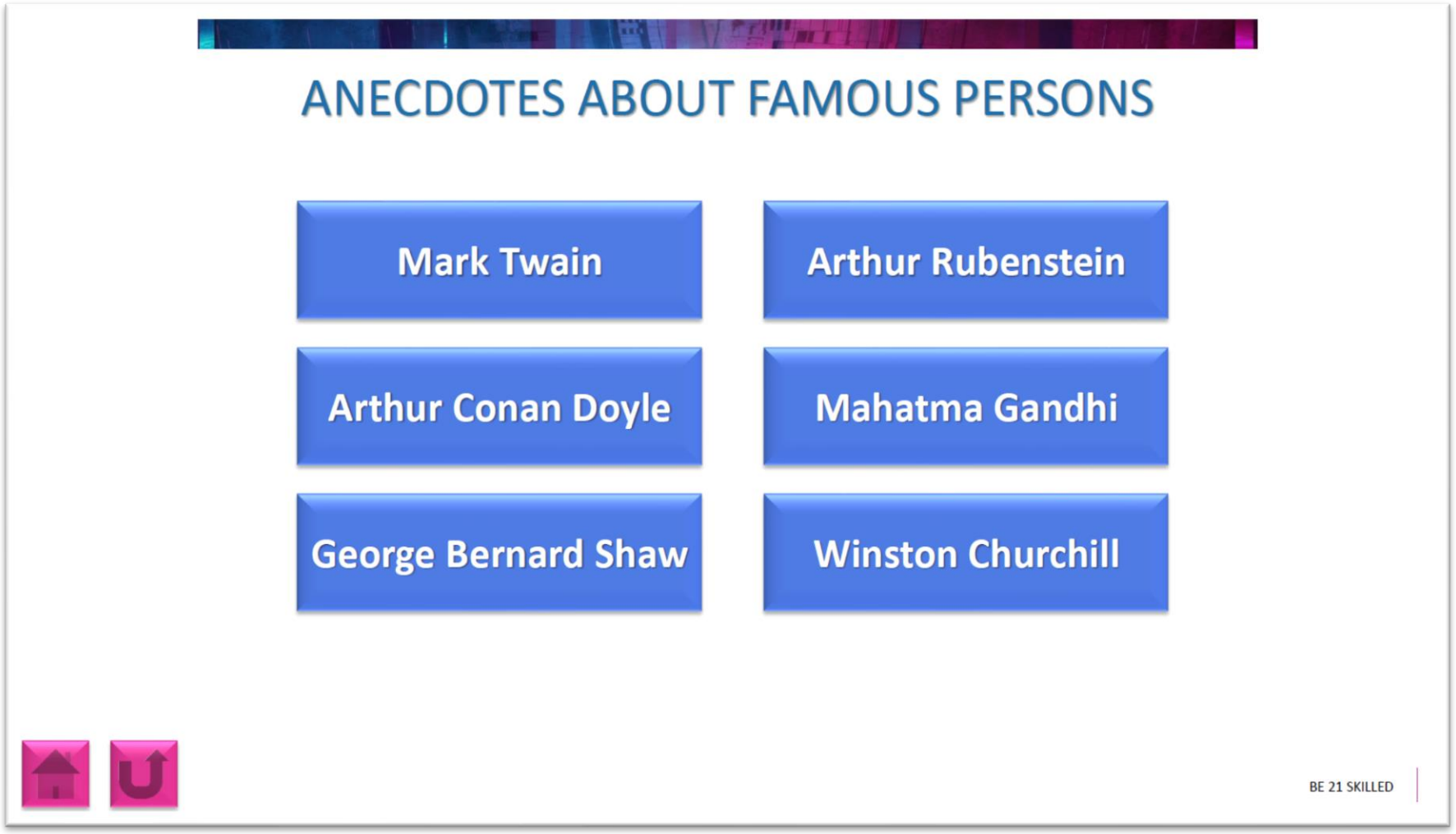
The central button of the **MAIN MENU** is **START** button which opens the **POSITIVE ATTITUDE IMPROVEMENT TOOL**:



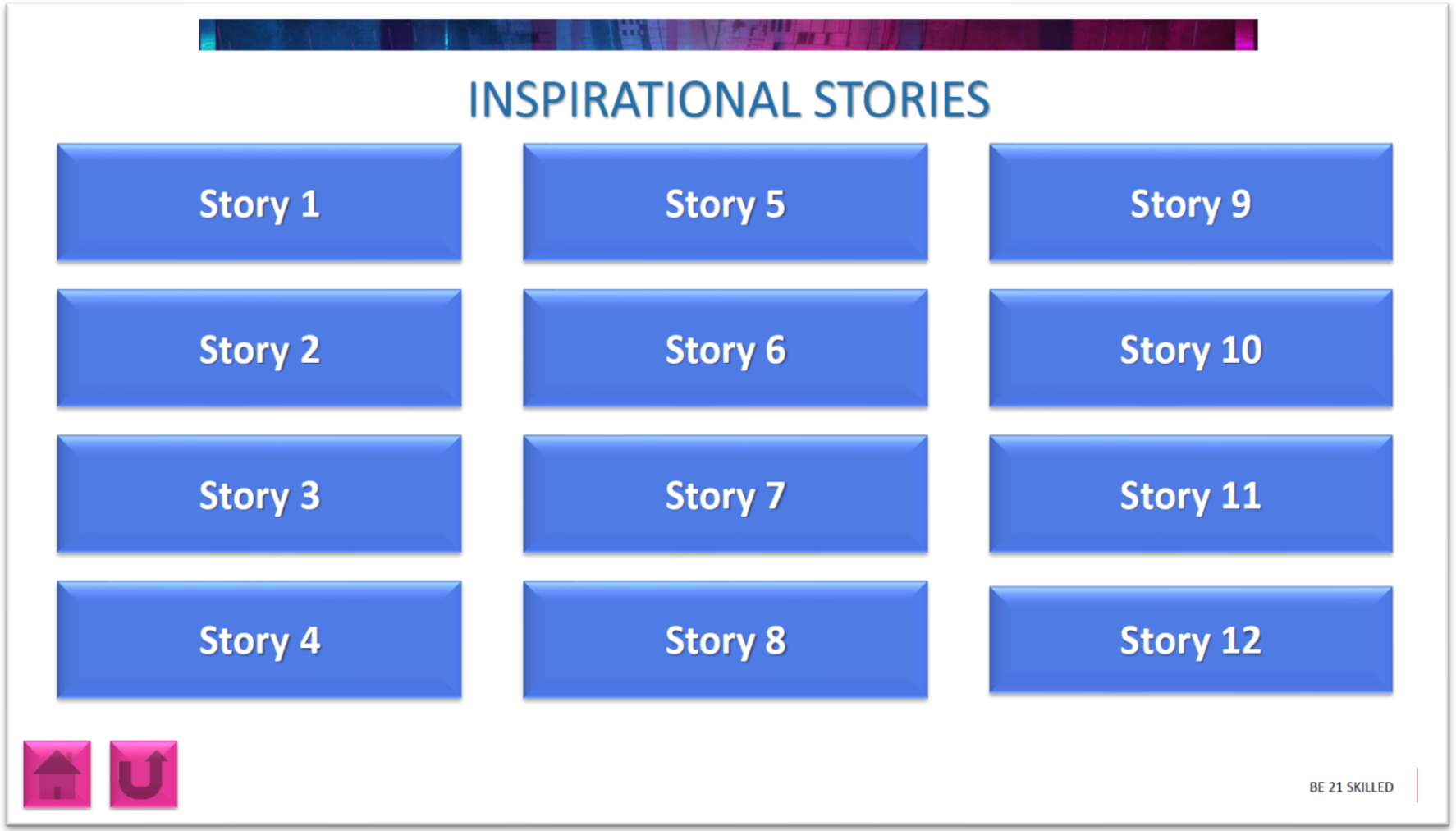
The **'RELAXING WEBSITES'** button leads to a slide with optimistic and relaxing websites:



The **'ANECDOTES ABOUT FAMOUS PERSONS'** button leads to a slide with short stories from the life of famous historical figures:

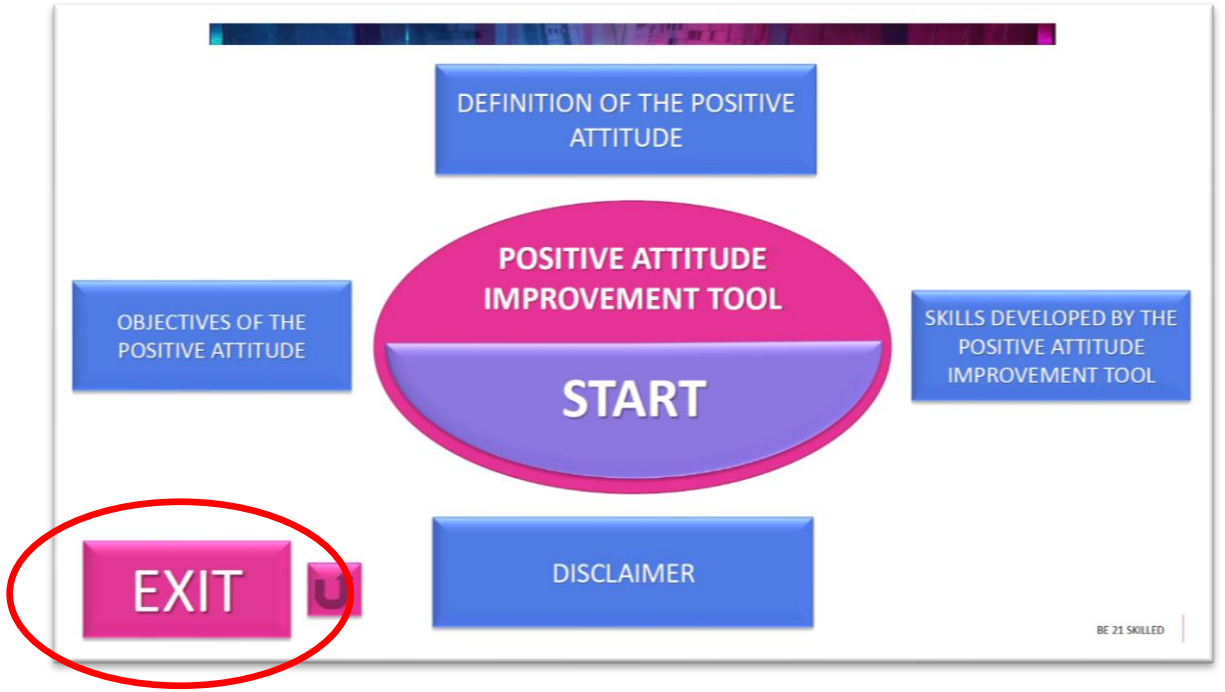


The **'INSPIRATIONAL STORIES'** button leads to a slide with fictional stories containing morals that contribute to the improvement of a positive attitude.



The **MOTIVATIONAL MUSIC/VIDEOS button** leads to the appropriate **YOUTUBE content:**

The application is closed via **EXIT button** in **START SCREEN** or the **MAIN MENU**:



TOOL DESCRIPTION + ITS RELEVANCE

REVERSE ENGINEERING TOOL

"Reverse engineering is the process of carefully analysing and deconstructing a product, system, or technology to comprehend its design, functionality, and implementation."

The main aim of the reverse engineering is to gain insight into how something works, even without access to its original design or documentation. This approach involves working backward from the final product, often in its compiled or binary form, to recreate its original source code or higher-level representation. Reverse engineering finds applications across various fields, such as software development, mechanical engineering, electronics, aerospace, and more.

It is particularly useful when dealing with closed-source software, legacy systems, or products with limited available design information. In software reverse engineering, developers utilize tools like disassemblers or decompilers to convert binary code into human-readable assembly language or higher-level programming languages. This enables them to study the program's logic, algorithms, and data structures, facilitating bug fixing, security analysis, or the creation of compatible software.

Similarly, in mechanical engineering, reverse engineering involves examining physical objects or components to recreate their CAD models or manufacturing specifications. It proves valuable when dealing with obsolete or hard-to-replace parts, historical artifacts, or proprietary components.

Reverse engineering tool can be used, among other, to improve the following skills: creativity, adaptability, curiosity, open mindset and spotting opportunities.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The Reverse Engineering tool is best used in classrooms midway through the semester, as it requires skills like teamwork, adaptability, creative thinking, and a positive attitude. Additionally, the reverse engineering exercise itself will enhance these skills.

LEARNING OUTCOMES

By using the Reverse engineering tool, students will be able to:

- Gain insights into the design principles and functional aspects of mechanical systems or components through the analysis of physical objects.
- Identify design flaws, manufacturing defects, or areas for improvement in products, leading to enhanced performance, durability, or efficiency.
- Discover alternative solutions when original parts become obsolete or are no longer accessible through reverse engineering.

TEACHING METHODS USED

To implement the Reverse engineering tool effectively, the following teaching methods are used:

- **Interactive presentations:** they help introducing the concept and implementation of the Reverse engineering.
- **Learning by doing:** students will improve their ability to improvise, adapt, and work in a team during the reconstruction (reverse engineering) of selected classroom objects.
- **Group discussions:** They allow students to engage in discussions about the achieved results of the reverse engineering activities.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Personal computer or laptop.
- Video projector (optional)
- Measurement instruments (rulers, measurement tapes, micrometers etc.)
- A set of tools for disassembly of classroom objects.

TARGET AUDIENCE (their characteristics and level)

The target audience of the Reverse Engineering tool will be STEM students of various programs and at different semesters in their studies. Teachers are also part of the target audience since they will be the ones instructing students on how to use the tool. Some of the students' specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Reverse Engineering tool are:

- Enhances student motivation and engagement.
- Effective communication becomes crucial to succeeding in the challenge, fostering better communication skills among participants.
- Individuals can learn from successful and well-designed products, applying those best practices to their own projects.
- It imparts valuable technical skills, such as CAD modelling, data analysis, and critical thinking. These skills can be transferable across various industries and job roles.

Disadvantages of the Reverse Engineering tool are:

- It involves analysing existing products or systems, which may raise issues related to intellectual property and copyrights. Unauthorized reverse engineering can lead to legal complications.
- Qualified professionals with expertise in reverse engineering may be scarce, making it challenging to find suitable trainers or practitioners.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Reverse Engineering tool can be adapted based on the specific needs and preferences of the students. Some possible variations include (instead of product reverse engineering which is in the scope of the tool):

- **Electronics Reverse Engineering:** Engineers analyse the circuitry and components of electronic devices and systems to comprehend their functionality.
- **Competitive Intelligence Reverse Engineering:** Engineers study competitor products or technologies to gain insights for benchmarking and strategic planning.
- **Biological Reverse Engineering:** In biotechnology, it studies biological systems, such as gene regulatory networks, to understand their functions.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the quality of Reverse Engineering tool usage, the following methods can be considered:

- **Self-assessment:** Students can personally reflect on the improvement of thier skills, such as adaptability, creativity, curiosity, open mindset and spotting opportunities – in written or oral form.
- **Goal progress tracking:** Students can track their progress and present updates periodically – using predefined questionaries or by reports in free form.

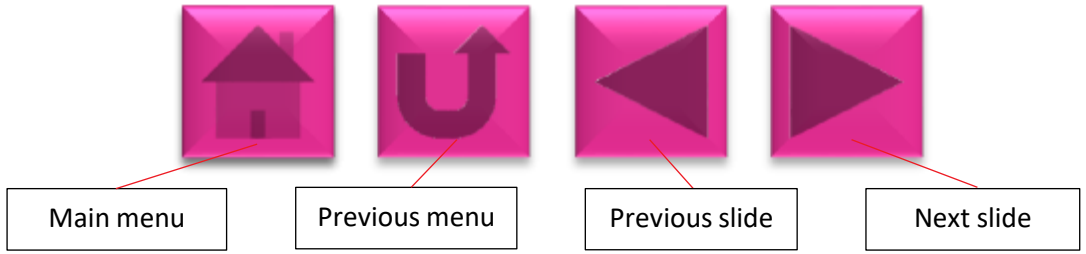
REVERSE ENGINEERING TOOL IS AVAILABLE AT THE – COPY ENTIRE FOLDER:
https://drive.google.com/drive/folders/1n8_tfsA02NODN16kTn1evvzvjDHsAdnF?usp=sharing

GUIDE FOR EDUCATORS

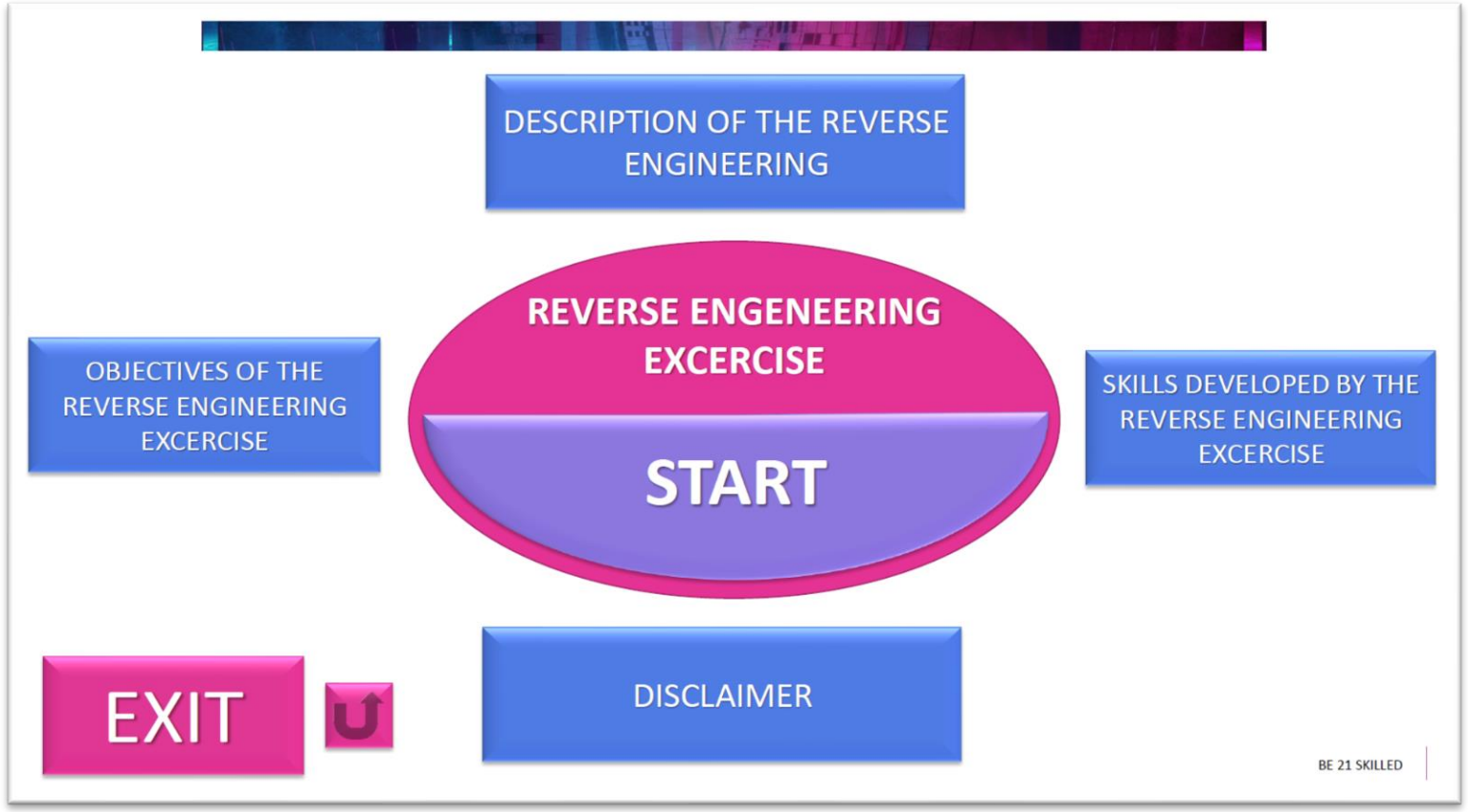
Instructions on how to use the Reverse Engineering

START SCREEN:

For navigation through the presentation, **NAVIGATION BUTTONS** at the screen bottom are used:



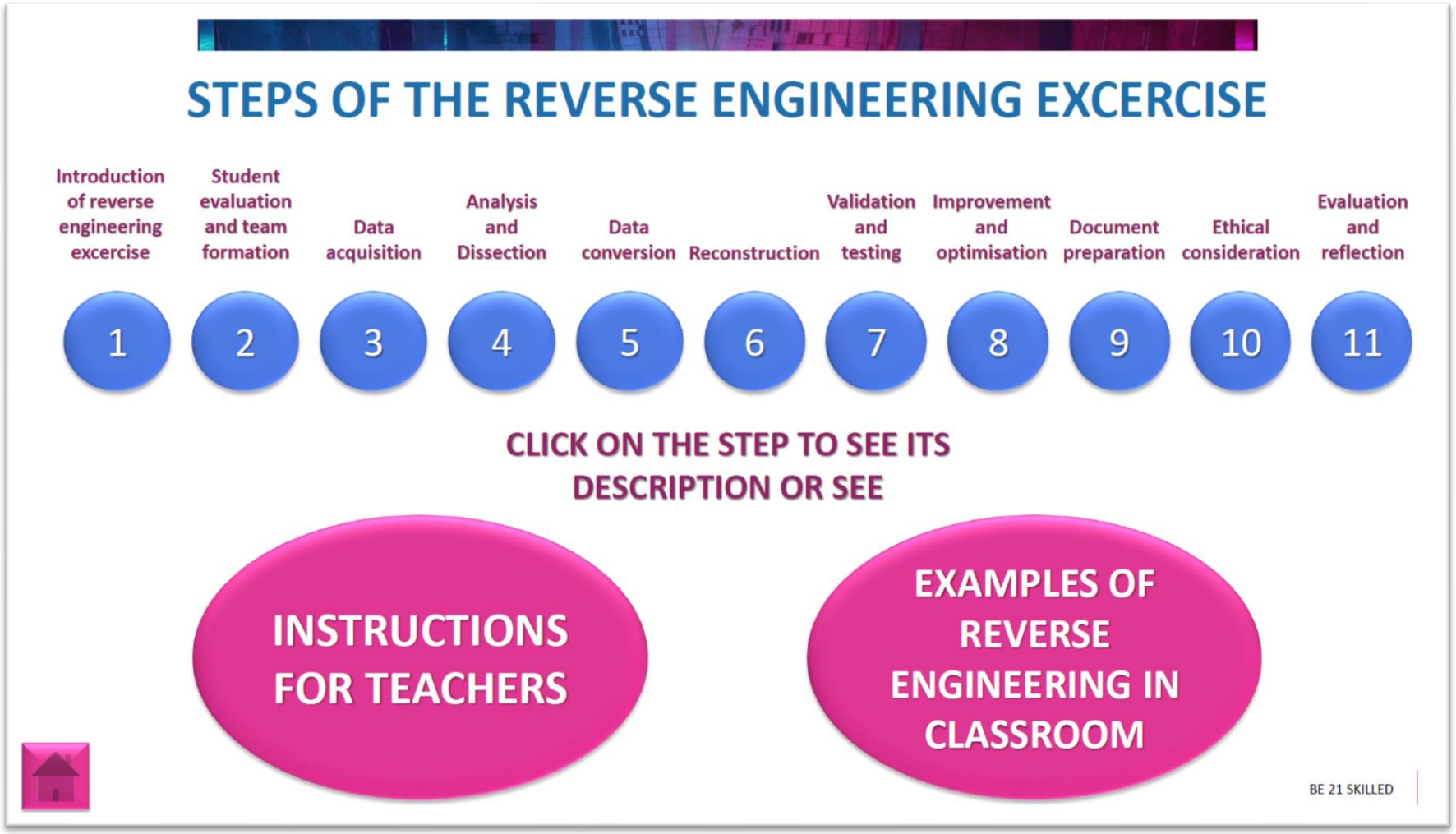
After the **START button** is pressed, the **MAIN MENU** opens:



In the **MAIN MENU** the following buttons can be pressed:

1. **DESCRIPTION OF THE REVERSE ENGINEERING**
2. **OBJECTIVES OF THE REVERSE ENGINEERING EXCERCISE**
3. **SKILLS DEVELOPED BY THE REVERSE ENGINEERING EXCERCISE**
4. **DISCLAIMER**

The central button on the **‘MAIN MENU’** is the **‘START’** button, which opens the **‘STEPS OF THE REVERSE ENGINEERING EXERCISE’**.



Press the **‘STEP BUTTONS’** to access slides with descriptions of each step. Alternatively, use the **‘NAVIGATION BUTTONS’** to navigate through the steps when a specific one is open."

Follow the very important step of **'STUDENT EVALUATION AND TEAM FORMATION'**, which includes the student evaluation form required for dividing students into teams of 5 members with similar skills.

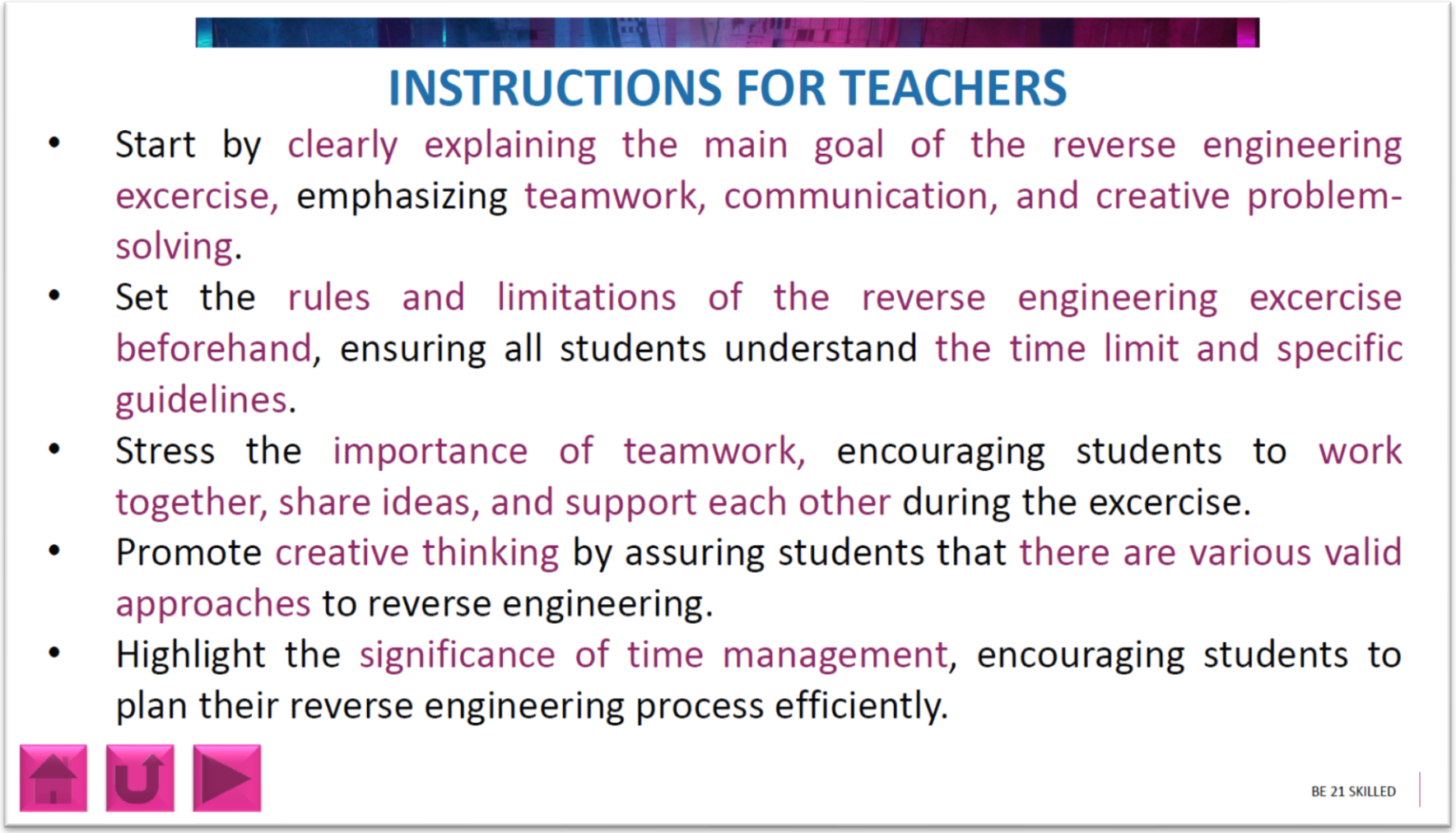
Student evaluation and team formation

- The students' abilities should be assessed based on the following questionnaire (click):

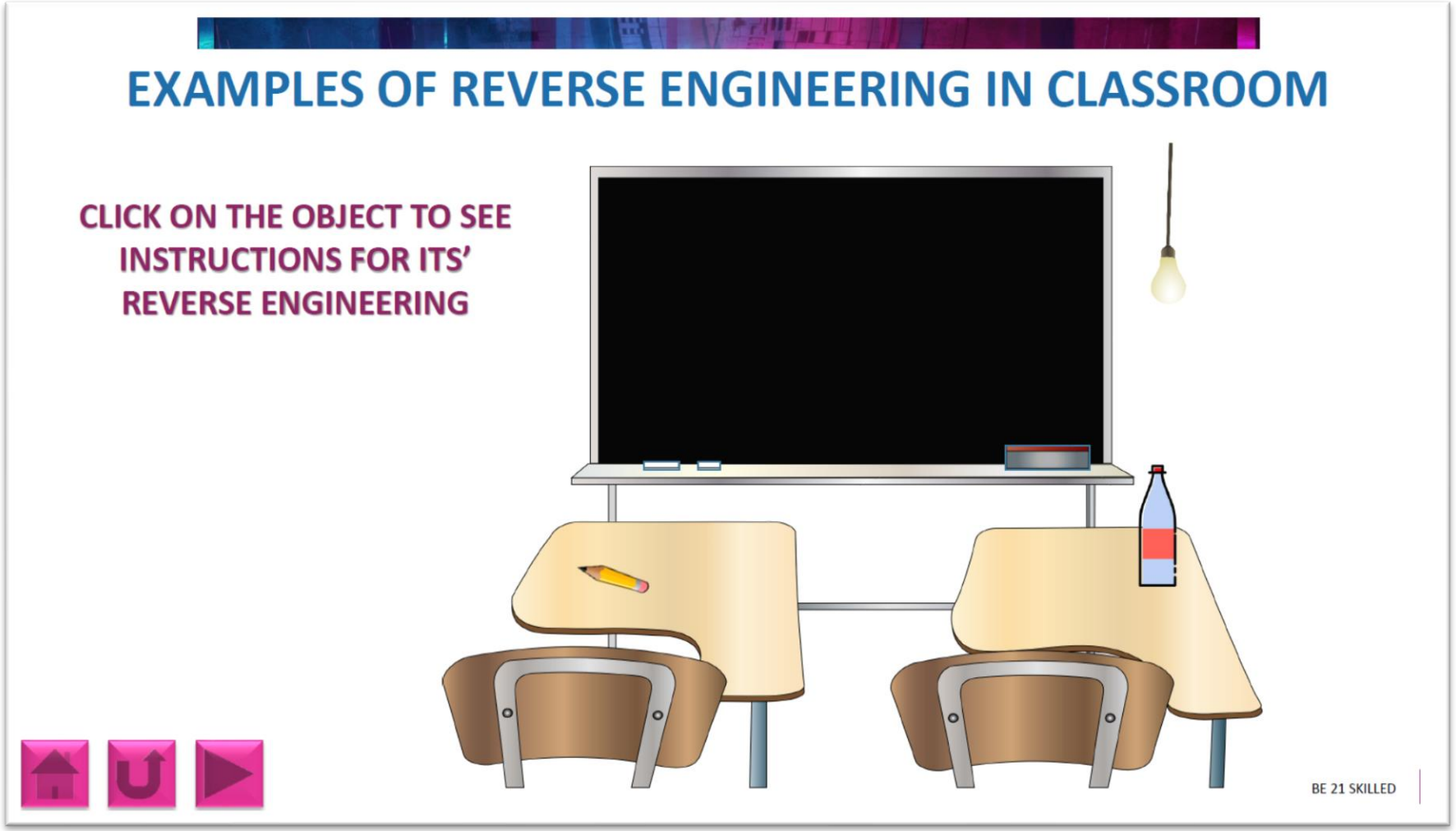
- After the evaluation, the students should be grouped into teams of 5 so the abilities of the teams are as equal as possible.

BE 21 SKILLED

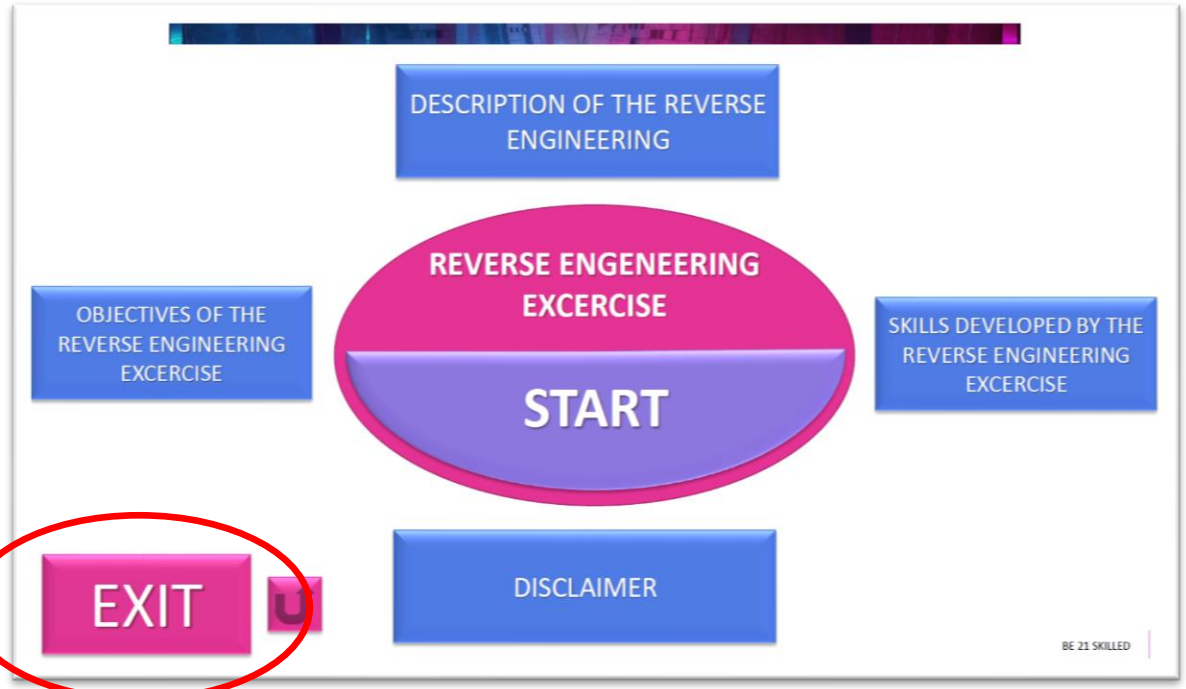
The button **INSTRUCTION FOR TEACHERS** (from the **STEPS OF THE REVERSE ENGINEERING EXERCISE MENU**) leads to detailed instructions how to implement the Reverse engineering exercise.



The '**EXAMPLES OF REVERSE ENGINEERING IN CLASSROOM**' button (from the **STEPS OF THE REVERSE ENGINEERING EXERCISE MENU**) provides detailed instructions for implementing the Reverse Engineering exercise on typical classroom objects. Click on the object to view its specific reverse engineering instructions.



The application is closed via the '**EXIT**' button in the **START SCREEN** or the **MAIN MENU**:



TOOL DESCRIPTION + ITS RELEVANCE

EdSurge

"EdSurge is the digital news and research magazine about education that illuminates, informs and ignites your curiosity. We bring you human-centered insights for a changing world."

EdSurge is a leading educational technology platform that provides insightful information about the intersection of technology, education, and the future of work. By merging news, research, and tool analysis, it provides educators and institutions with insights into how technology can enhance learning outcomes, especially in the STEM disciplines.

It is a nonprofit newsroom reporting on the powerful forces, fascinating people and innovative practices shaping teaching and learning. To support this mission, they accept grants from philanthropic organizations that are committed to editorial independence.

By integrating EdSurge into regular pedagogical practices, educators can stay at the forefront of STEM education, ensuring they equip students with the most relevant skills and knowledge for the future.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

EdSurge serves as a comprehensive resource for educators' keen on integrating the latest in technology into their teaching methodologies. When STEM teachers are on the lookout for emerging technologies that have the potential to redefine classroom experiences, EdSurge stands out with its in-depth tool reviews and insightful articles. Beyond just introducing new tools, it offers a wealth of knowledge for curriculum enrichment.

By leveraging articles that discuss the most recent STEM methodologies, educators can seamlessly introduce their students to current trends, potential challenges, and a forward-looking perspective on the future of STEM. This not only keeps the curriculum updated but also ensures that students are well-prepared and informed about the ever-evolving landscape of STEM disciplines.

LEARNING OUTCOMES

By using the EdSurge tool, students will be able to:

- Stay informed about the latest advancements and applications in STEM, connecting classroom learning to real-world scenarios.
- Access resources and tools that enhance their understanding and engagement with STEM subjects.
- Explore diverse career pathways and opportunities within the STEM field.
- Engage with interactive content that reinforces critical thinking and problem-solving skills.
- Collaborate and discuss emerging trends, fostering a community of continuous learners.

TEACHING METHODS USED

To implement the EdSurge tool effectively, the following teaching methods can be used:

- **Interactive Discussions:** After students read a selected EdSurge article, facilitate classroom discussions to dissect and debate the content, ensuring comprehension and encouraging critical thinking.
- **Project-Based Learning**: Assign student projects based on a novel tool or method showcased in EdSurge. This not only provides hands-on experience but also encourages students to adapt to new technologies and methods.
- **Case Study Analysis**: Convert EdSurge articles into case studies. Have students analyze the challenges, solutions, and outcomes presented, promoting analytical skills.
- **Peer Teaching**: After grouping students and assigning different EdSurge features to each group, let them teach their peers about what they learned. This enhances both comprehension and communication skills.
- **Guest Sessions**: If possible (but may require a budget), identify key experts highlighted in EdSurge features and invite them for guest lectures or webinars, allowing students direct interaction and deeper dives into the topic.

SPECIFIC RESOURCES/ EQUIPMENT USED

- EdSurge subscription to free content and access to podcasts
- An internet connection
- Devices for browsing EdSurge,
- A projection system for group discussions or showcasing articles/tools.

TARGET AUDIENCE (their characteristics and level)

The target audience for using EdSurge will be STEM educators, educational technologists, administrators, and students seeking to understand the direction in which STEM industry are headed. It is also very relevant to STEM students of various programmes and at different semesters in their studies, and those with:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the EdSurge tool are:

- Regularly updated with the latest in edtech and STEM methodologies.
- Credible information with insights from experts and practitioners in the field.
- Offers a diverse range of perspectives, from teachers to administrators to tech developers.
- It is a free to use platform.

Disadvantages of the EdSurge tool are:

- It is a US based tool, but its learning and insights are very applicable to all
- The sheer volume of information can be overwhelming for newcomers.
- While it covers a wide range of topics, some educators might desire more depth in specific areas.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Some ideas on possible adaptations of the EdSurge tool include:

- **Workshops**: After gaining insights from EdSurge, organize hands-on workshops to try out new tools or methods.
- **EdSurge Digest**: Create a monthly digest or newsletter for students and other faculty members, summarizing key insights and links from EdSurge.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:-

- **Classroom Discussions:** Host open discussions where students can share their views and experiences with the new content or method integrated.
- **Collaborative Evaluation:** Organize sessions where educators collaboratively review and assess the deployment of new techniques sourced from EdSurge. This allows for a diversity of viewpoints and a richer assessment. If the projects were group-based, include peer evaluations. This ensures a comprehensive understanding of individual contributions and group dynamics.
- **Reflection Essays:** Ask students to write a short reflection on their experiences with the new tool or methodology. This not only gauges their understanding but also attitudes towards spotting opportunities.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:-

- **Rubric-Based Assessment:** Create a specific rubric that focuses on the objectives of the EdSurge-inspired project, ensuring that evaluations are consistent and aligned with intended outcomes.

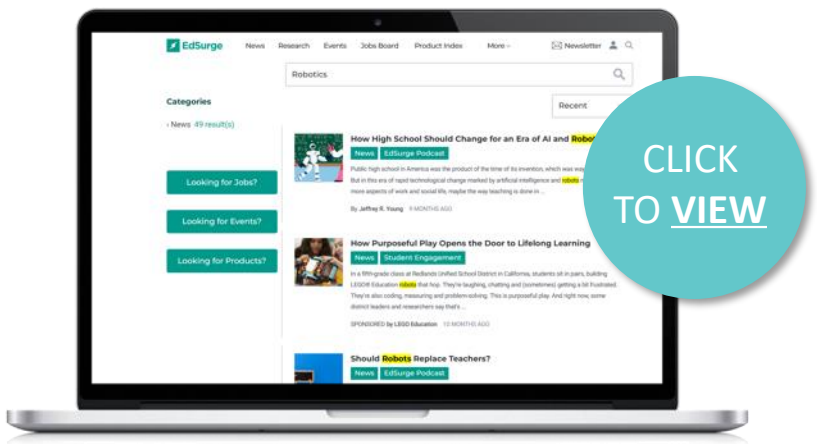
- **Presentation and Defense:** Ask students to present their projects to the class, defending their choices and methodologies. This not only assesses their comprehension but also their communication skills and confidence in their work.

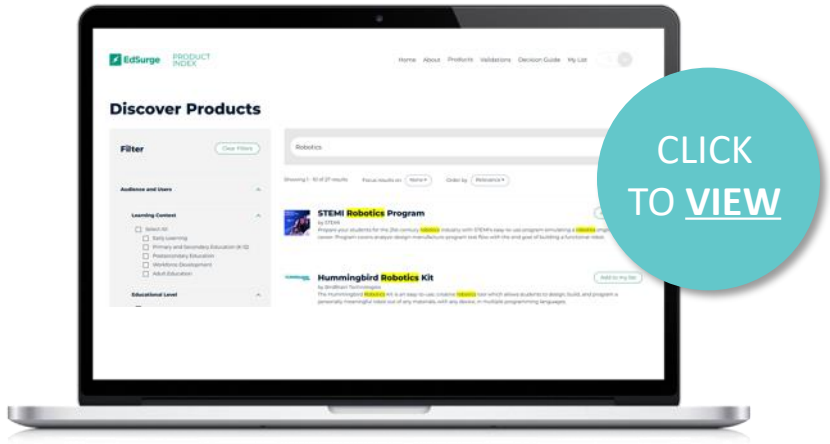
GUIDE FOR EDUCATORS

Steps for Integrating the EdSurge Tool into STEM Education

01 | Research and Discovery

- Access the EdSurge platform https://www.edsurge.com/, create an account on SignUp (edsurge.com)
- Ask all involved, educators and students to explore key topic areas via the EdSurge news search tool https://www.edsurge.com/ search
- Produce Index https://index.edsurge.com/. Keep your research broad for best results





02 | Selection and curation

- Identify relevant articles or tools that resonate with your classroom objectives.
- Bookmark or save these for future reference and lesson planning.

03 | Lesson integration

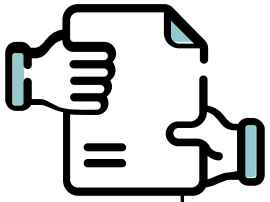
- Plan a lesson or module around the chosen content.
- Determine if any supplementary materials or technologies are needed

04 | Student engagement

- Introduce the topic using the EdSurge content as a reference.
- Engage students with discussions, Q&A sessions, and interactive activities related to the content.

05 | Guest invitations (optional):

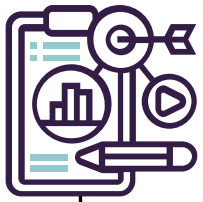
- Identify and invite experts or innovators featured in EdSurge articles for guest lectures or webinars.



06 | Project assignment

- Design and assign projects based on the featured tool or method in EdSurge.
- Encourage students to explore and apply what they've learned in a practical manner.

07 | Review and feedback



- Conduct classroom discussions post-project to evaluate understanding.
- Distribute feedback surveys or reflection essays to gauge the effectiveness of the integrated method.
- Peer Review: Share experiences and gather feedback from fellow educators about integration. Collaborate on refining the approach for better outcomes in future lessons.

08 | Iterate and Enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.
- Return to EdSurge and consider becoming a contributor.

WELLBEING, POSITIVE ATTITUDE, MINDFULNESS

06

06|WELLBEING, POSITIVE ATTITUDE, MINDFULNESS

This cluster deals with a broad spectrum of interconnected qualities, including aspiration, efficacy and beliefs, gratitude, identity, metacognition, mindfulness, motivation, positive self-evaluation, reflection, self-competencies, trust, and overall wellbeing (Līce, et al., 2023).

According to the American Psychological Association (2023), well-being is “a state of happiness and contentment, with low levels of distress, overall good physical and mental health and outlook, or good quality of life.” Good well-being allows individuals to create a supportive work environment, strengthen social ties and lead to an overall happier and healthier life.

On the other hand, Līce, et al., (2023) argue that “positive attitudes, optimism and a sense of personal purpose enhance the motivation to actively pursue long term goals” (p. 38).

Cultivating **wellbeing,** maintaining a **positive attitude,** and integrating **mindfulness** into daily practices contribute to personal balance and professional accomplishment. This approach ensures that individuals navigate challenges with resilience, focus, and the capacity to derive meaning from their experiences, ultimately enriching their journey.

TOOL DESCRIPTION + ITS RELEVANCE

"Using the Headspace app is like having a personal guide to mindfulness right in your pocket; it's an invaluable resource for achieving mental clarity and well-being in our busy lives."

Headspace is a meditation app designed to improve mental, physical, and spiritual health. In an educational context, teachers can introduce students to the app for a shared meditation session, followed by weekly individual sessions as homework. The comprehensive lesson plan aims to teach students about mindfulness and meditation, allowing them to use Headspace for better mental well-being.

To utilise, students download and navigate the app for various functions, from meditation to sleep aids. The teaching strategy involves demonstrations, practical applications, and group discussions. While the app is beneficial for its vast content and tracking features, concerns include screen time and costs. Classrooms without personal devices can broadcast sessions, and budget-friendly apps like "Stop, Breathe & Think" offer alternatives. Student progress can be evaluated within the app.

Offering concise, guided meditation sessions for beginners and featuring a broad range of content, from mindful workouts to sleep improvement techniques, Headspace is a great tool for increasing the mindfulness of students.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

In the classroom, students can be introduced to the concept of mindfulness, and the initial mindfulness session can be conducted as a group activity. This will help students become acquainted with the app and its functionalities. Subsequently, they can be assigned 'homework' to complete one mindfulness session per week.

e.g. Lesson Title: Introduction to Mindfulness and Meditation

LEARNING OUTCOMES

The app encourages continued learning by tracking progress, answering mindfulness queries, and offering daily inspiration. It seeks to improve users' mental health, stress management, focus, physical health, and sleeping habits.

By using the Headspace tool, students will be able to:

- Learn the basics of mindfulness and meditation, and how to utilise the Headspace app to manage stress
- Improve focus and enhance their overall well-being.

TEACHING METHODS USED

To implement the Headspace tool effectively, the following teaching methods can be used:

- **Lecture**: The 10-minute introduction is a basic talk explaining mindfulness.
- **Demonstration:** The teacher shows how to use the Headspace app for 15 minutes.
- **Practical Exercise:** Students do a 10-minute guided meditation, offering hands-on experience.
- **Group Discussion:** A 10-minute chat allows students to share experiences, encouraging interaction.
- **Homework**: Daily guided meditation tasks give students real-world practice.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Smart devices (smartphone or tablet) with the Headspace app installed.

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programs and at different semesters in their studies. Some of their specific characteristics could be:

- Individuals with a range of prior knowledge and experience.
- People with various learning methods and likes.
- Students from a mix of backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Headspace Tool are:

- Headspace offers convenient and cost-effective access to a wide range of customisable mindfulness and meditation programs. They support users' well-being by providing guided sessions, progress tracking, community support, learning resources, and mindful reminders, enhancing stress management, focus, emotional health, and sleep quality.

Disadvantages of the Headspace tool are:

- The need for certain type of technology to use this tool.
- Increased screen time which might lead to problems like eye strain, sleep issues, or decreased physical activity.
- Cost: While many apps offer free content, premium features often require a subscription, which might be a financial burden for some students.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

- In cases where students lack access to suitable technology for utilising the Headspace app within the classroom, the teacher can facilitate a collective listening experience by playing the audio clips aloud for the entire class to engage with synchronously
- An alternative mindfulness app is "Smiling Mind" App — Smiling Mind

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:-

- **Class Chats:** Run open talks so students can share what they think and feel about using Headspace in the classroom.
- **Joint Reviews:** Set up meetings where teachers work together to evaluate how well Headspace has been integrated. This makes the feedback more varied and complete. If teamwork was involved, add peer reviews to understand everyone's role better.
- **Thought Pieces:** Ask students to jot down a quick piece about their experience using Headspace. This checks not only their understanding but also their outlook on finding new opportunities.

GUIDE FOR EDUCATORS

Steps for Integrating the **Headspace Tool** into STEM Education

01 | Research and Discovery

- Ask all involved educators to download the Headspace app, and encourage them to participate in a session
- This means the educators will be able to see the benefits of Mindfulness apps for themselves!

02 | Selection and curation

- Once the educators have witnessed the effects of the Headspace App, they can decide on which courses they would like to use and the nature of its implementation in their classroom.

03 | Lesson integration

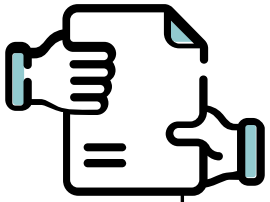
- Plan a lesson or module around the activity.
- Make sure to have the necessary equipment (ensuring students either have their own device or alternatively play the Headspace app course out loud for all the students from a computer or radio device.

04 | Student engagement

- Once you have decided how the students will listen to the Headspace Programme, encourage them to listen to the introductory videos first, easing them in to this new way of thinking and breathing.

06 | Project assignment

- Once the class learns more about Mindfulness and the Headspace App, you can assign students to listen to an hour (or given time you feel appropriate) of the programme per week as homework.



07 | Review and feedback

- Have a brief chat after the activity to gauge students' understanding and thoughts on mindfulness.
- Feedback Surveys or Essays. Hand out short questionnaires or assign quick reflection tasks to measure the activity's impact.
- Peer Review with Educators. Talk to fellow teachers who've used the activity to discuss its effectiveness and possible improvements.

08 | Iterate and Enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.

TOOL DESCRIPTION + ITS RELEVANCE

PERMA Model

The PERMA model was developed by Martin Seligman, a pioneer in the field of positive psychology. It is a comprehensive framework that highlights the five core PERMA elements of psychological well-being and happiness:

- Positive Emotion,
- Engagement,
- Relationships,
- Meaning, and
- Accomplishments.

The model is valuable as it encourages mindfulness, resilience, and positive thinking, skills that are crucial for students and the future workforce.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

The PERMA model can be integrated into teaching across different subjects and education levels. Teachers can weave elements of the model into existing lesson plans or use it as a standalone tool. For instance, use the PERMA tool to create an immersive, hands-on project, such as designing an environmentally friendly technology or a novel application of artificial intelligence. By immersing themselves in this project, students will find a state of "flow," where they become highly engaged and apply principles of positive psychology in the assigned task.

LEARNING OUTCOMES

By using the PERMA tool, students will be able to:

- Recognize engagement activities that fully immerse them and create a sense of "flow." This understanding can help them choose future tasks, projects, or even career paths.
- Connect their day-to-day activities, studies, and future work ambitions with a broader purpose, creating a deeper sense of fulfilment and motivation.
- Develop a mindset of growth and resilience and understand that both success and failure are part of the journey to achieving their goals, cultivating resilience in the face of challenges.

TEACHING METHODS USED

To implement the PERMA tool effectively, the following teaching methods can be used:

- Interactive Lectures: Instead of traditional lectures, adopt an interactive approach where students actively share related experiences or observations, which in turn can prompt insightful conversations about well-being and happiness.
- Use real-life or hypothetical case studies that embody the PERMA elements. These can be analyzed individually or in groups, providing practical examples of the model's concepts. This is particularly useful for abstract
- Encourage students to keep a PERMA journal. Regularly assigned prompts can guide students in reflecting on their experiences related to Positive Emotion, Engagement, Relationships, Meaning, and Accomplishment.
- Assign projects that encourage students to apply the PERMA model in real-world context.

SPECIFIC RESOURCES/ EQUIPMENT USED

- Teaching aids such as workbooks, slides, videos can enhance understanding.
- For online learning, virtual whiteboards and breakout rooms can facilitate discussion and group work.

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programmes and at different semesters in their studies. Teachers are also part of the target audience since they will be the ones instructing students on how to use the tool. Some of the students' specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the PERMA model include

- its holistic approach to well-being, its promotion of positive psychology, and its adaptability to different audiences and contexts.
- unlocking skills of self-reflection, resilience, and empathy.

Disadvantages of the PERMA model include

- its abstract nature, which may make it hard for some individuals to apply it to their lives without guidance.
- as it's centred around self-reflection, it may be less effective for those uncomfortable with introspection.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

While the PERMA model is inherently adaptable, adaptations may be made to enhance its effectiveness within STEM education. For example:

- Create scenarios or use case studies that revolve around situations familiar to STEM students. This might include managing team dynamics during a group project, finding purpose in a complex assignment, or experiencing achievement in problem-solving.
- Connect elements of the PERMA model with current issues or hot topics in STEM fields. For instance, discussing the role of positive relationships within the context of collaborative scientific research, or exploring the sense of accomplishment that comes with technological innovations.
- Given that STEM students are often tech-savvy, digital tools like apps, online self-assessment quizzes, or digital journals can be used to explore the PERMA model elements.
- For those nearing graduation or interested in specific careers, connect the PERMA model to workplace wellbeing, teamwork, and job satisfaction within various STEM careers.

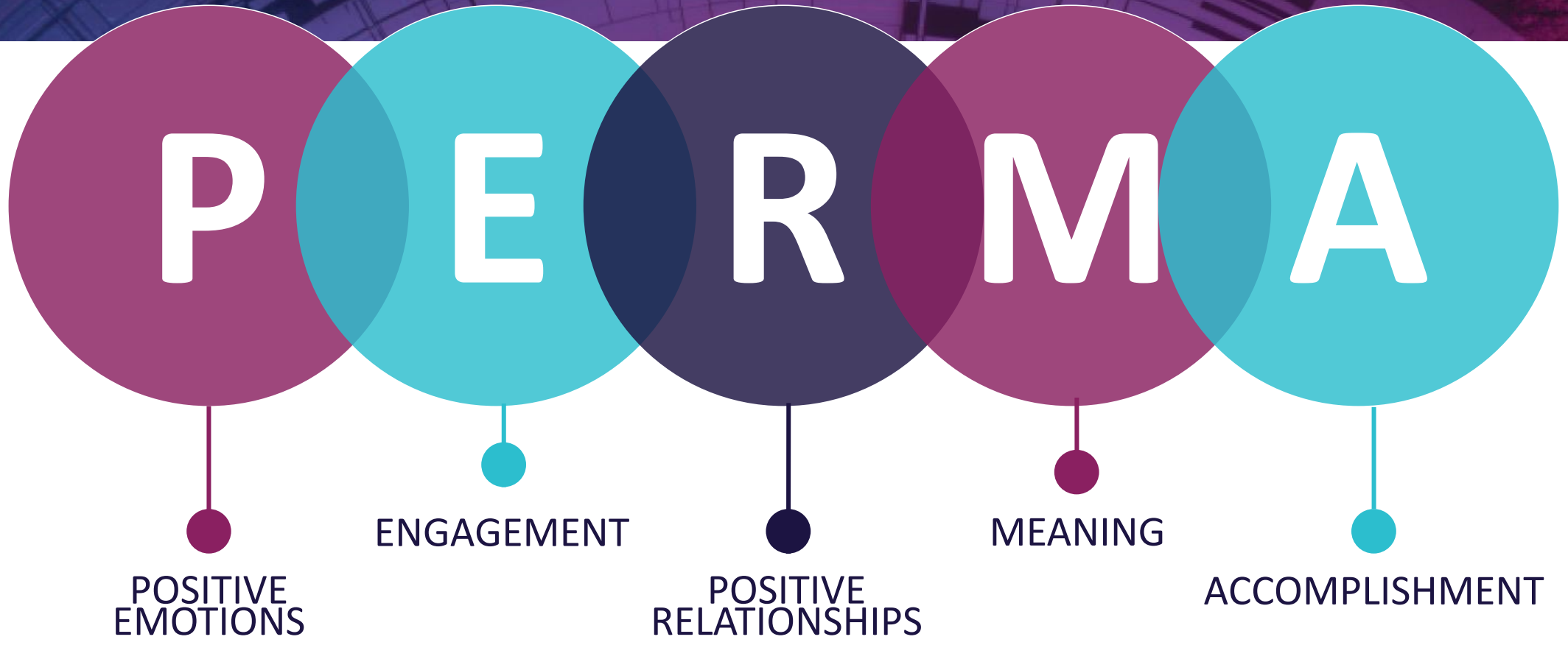
MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing STEM students using the PERMA model, it's vital to make the assessment process a learning experience. The aim should be to foster a deeper understanding of their well-being and how it intertwines with their academic and future professional lives. Consider the following assessment methods:

- **Lab Journal Annotations**: STEM students often keep lab journals. Beyond just documenting experiments or results, students can be asked to annotate their journals with reflections on PERMA elements. For instance, after a challenging experiment, a student might write about their feelings of accomplishment.
- **Project Post-Mortems:** After major projects or presentations, hold a session to reflect on the project using the PERMA framework. Discuss emotions felt during the project, points of deep engagement (or lack thereof), interpersonal dynamics, and the broader meaning or significance of the project.
- **STEM-Specific Peer Feedback**: Given the often-collaborative nature of STEM work, peers can provide feedback on elements like teamwork (Relationships) and problem-solving strategies (Accomplishment).
- **Case Study Analyses:** Present students with STEM-specific scenarios where characters face challenges related to PERMA elements. Analysing these scenarios can help assess students' understanding of the PERMA model in the context of their field.
- **Simulation Reflection:** For STEM fields that use computer simulations, after a simulation session, students can reflect on aspects such as engagement (were they immersed in the task?) and accomplishment (did they achieve their simulation objectives?)
- **Interactive STEM Webinars:** Use webinars to discuss the latest scientific breakthroughs or technologies, followed by discussions framed around the PERMA model. Students can reflect on the meaning and broader significance of these advances, their emotional reactions, and more.
- **Periodic Check-ins:** Set up regular intervals where students fill out surveys that are customized to gauge the PERMA elements in the context of their STEM education. For instance, inquire about their sense of meaning when tackling a particularly challenging problem set or their emotions during a group project.

INTEGRATING THE PERMA MODEL INTO STEM EDUCATION

requires tailoring each component to STEM-specific situations and challenges



GUIDE FOR TEACHERS

Integrating the PERMA Model into STEM Education

The **PERMA model**, rooted in positive psychology, promotes overall well-being by emphasizing Positive emotions, Engagement, Relationships, Meaning, and Accomplishment. By integrating this model into STEM education, educators can cultivate a more holistic, enriching, and motivating learning environment for students.

The essence of integrating the PERMA model is not just about academic achievement but fostering a love for learning, promoting interpersonal skills, and equipping students to find meaning and joy in their STEM journey. Here's a step-by-step guide to be used in the context of our table of PERMA examples and applications :

01 | Familiarize with PERMA Elements

- Before attempting to integrate, educators should thoroughly understand each element of the PERMA model. This ensures effective and genuine integration into teaching methods.

02 | Start with 'Positive Emotion'

- **Set the Scene:** At the beginning of a lesson, share a fascinating fact, demonstration, or insight related to the topic.
- **Encourage Sharing:** After experiments or problem-solving sessions, allocate time for students to share their "wow" moments or what they found intriguing.
- **Celebrate Small Wins**: Recognize and appreciate students' curiosity, questions, or when they make unique observations.

03 | Foster 'Engagement'

- **Introduce Project-Based Learning:** Allow students to pick a topic or problem they're passionate about. It should be challenging enough to keep them engaged but aligned with their skills.
- **Diverse Learning Methods:** Use simulations, hands-on experiments, and field trips to cater to different learning styles and promote deep engagement.
- **Reflect on Flow:** Discuss with students about moments they felt lost in their work, helping them identify and seek their own flow states.

04 | Cultivate 'Relationships'

- **Group Projects:** Intentionally mix students of diverse strengths and backgrounds. Change group compositions periodically to ensure everyone gets to work with different peers.
- **Team Building:** Begin group projects with ice-breakers or team-building exercises to foster trust and camaraderie.
- **Conflict Resolution:** Equip students with skills and platforms to communicate and resolve conflicts, emphasizing the importance of mutual respect.

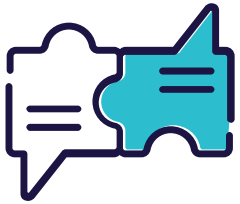
05 | Highlight 'Meaning'

- **Connect to Real World:** Begin lessons with questions about real-world applications. How does this math concept play out in architecture? Why is this biological process crucial for medicine?
- **Guest Speakers:** Invite professionals in STEM fields to talk about their work, emphasizing the broader impacts and societal contributions.
- **Ethics and Responsibility:** In advanced lessons, integrate discussions on the ethical implications of technologies or discoveries, making students ponder on the broader meaning of their studies.

06 | Promote 'Accomplishment'

- **Set Milestones:** For larger projects or lessons, break down objectives into smaller milestones, celebrating each when achieved.
- **Encourage Peer Teaching:** After mastering a concept, allow students to teach or help peers. This not only reinforces their understanding but also gives a sense of accomplishment.
- **Reflect on Achievement:** Periodically, ask students to reflect on what they've learned and achieved, cultivating a growth mindset.

07 | Continuous Feedback



- Use surveys, one-on-one sessions, and class discussions to gather feedback on PERMA integration. Understand what's working and where you can improve.

08 | Evolve and Adapt

- The world of STEM is dynamic. Continuously update the curriculum and teaching methods, ensuring the PERMA model's integration remains relevant and effective.

EMOTIONAL INTELLIGENCE AND EMPATHY

07

07 | EMOTIONAL INTELLIGENCE AND EMPATHY

This cluster covers a range of elements, including understanding another's emotions, experiences, and values, as well as the capacity to provide suitable responses (Līce, et al., 2023). The development of emotional intelligence includes factors that reduce stress, such as conflict moderation, fostering understanding and relationships, and promoting stability and harmony, benefiting both individuals and organizations.

According to Goleman, D (2005), studies show that people who understand and manage their own emotions well, as well as navigate and respond effectively to the emotions of others, have various advantages in all aspects of life.

Sala et al., (2020) as cited in Līce, et al., 2023), argue that empathy is the basis of comprehending and connecting with others on an emotional level. It is the capacity to be aware of someone's emotions. Emotional intelligence, connected with empathy, enables effective communication, interaction, and collaboration. This mixture equips individuals with the tools to navigate complex social dynamics, fostering a balanced work environment and promoting fruitful teamwork.

TOOL DESCRIPTION + ITS RELEVANCE

Emotional Intelligence (EI) Software and Training Courses

Emotional Intelligence (EI) Software and Training Courses aim to enhance an individual's skill in understanding and managing emotions. This is particularly useful for STEM (Science, Technology, Engineering, and Mathematics) students who often focus solely on technical skills. Incorporating emotional intelligence into their education can aid in teamwork, problem-solving, and stress management.

As STEM fields usually involve collaboration and leadership roles, having a strong emotional quotient (EQ) can make a significant difference. Training in emotional intelligence can offer practical exercises and real-life examples to help students develop these skills. This makes them not just technically competent but also emotionally intelligent, preparing them for a well-rounded career in STEM industries.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

To implement Emotional Intelligence (EI) Software in a STEM educational setting, start by assessing the specific emotional needs of the students and setting clear objectives for what you want the tool to achieve. Once the needs and goals are outlined, research and select an EI software that aligns with these objectives and fits your budget, focusing on features like customisation, integration with existing curriculum, and user-friendliness.

Next, secure the necessary resources, ensuring adequate devices and internet connectivity for all students. Provide training for educators so they know how to use the software and integrate it into their teaching, possibly through professional development sessions. Plan how the software will be incorporated into the existing curriculum and create a regular schedule for its use. Introduce the software to students, explaining its purpose and providing guidelines for navigation. Finally, monitor progress regularly using the software's analytics and offer additional support as needed.

LEARNING OUTCOMES

By using Emotional Intelligence (EI) Software, students will be able to:

- Develop self-awareness and emotional regulation, enabling effective problem-solving and stress management.
- Foster empathy, enhancing social awareness and relationship-building skills for collaboration and cultural sensitivity in STEM teamwork.
- Improve communication skills and conflict resolution, preparing students for real-world collaboration in STEM fields.
- Equip students to navigate real-world challenges, preparing them for workplace dynamics and personal growth, essential for success in STEM careers.

TEACHING METHODS USED

Teaching Emotional Intelligence (EI) to STEM students involves a combination of methods to ensure both understanding and application:

- **Interactive Lectures:** Engage students with relatable examples.
- **Group Activities:** Foster teamwork and empathy through collaboration.
- **Role-Playing:** Enable practice of emotional responses.
- **Reflective Journaling:** Encourage self-awareness.
- **Multimedia Integration:** Utilise videos or interactive software.
- **Guest Speakers:** Bridge theoretical concepts with real-world applications.
- **Workshops:** Provide hands-on experiences.
- **Peer Review:** Build community through assessment and feedback.
- **Individual Support:** Offer counseling or coaching if possible.
- **Integration with STEM Projects:** Blend EI principles into existing curriculum.
- **Assessment:** Evaluate both understanding and application.
- **Use of EI-specific Tools:** If available, use specialised software

SPECIFIC RESOURCES/ EQUIPMENT USED

- Interactive Software: For scenarios, games, and personalised feedback
- Multimedia Tools: Videos, documentaries, and podcasts related to EI
- Collaborative Tools: Online platforms for group projects and discussions

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programs and at different semesters in their studies. Some of their specific characteristics could be:

- Individuals with a range of prior knowledge and experience
- People with various learning methods and likes
- Students from a mix of backgrounds and interests

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the tool are:

- It helps students develop both technical and soft skills like empathy.
- Improves communication and collaboration in STEM projects.
- It teaches effective ways to handle stress.
- Prepares students for leadership roles in STEM careers.

Disadvantages of the tool are:

- Quality software may be expensive and not always affordable for schools.
- It requires reliable devices and internet, which may not be accessible to all.
- Integrating into existing curriculums can be challenging.
- Digital training's impact compared to in-person coaching is debatable.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

Emotional Intelligence (EI) tools in STEM education can be tailored to suit various needs through age-appropriate modifications, cultural adaptations, accommodations for special needs, integration with specific STEM subjects, and adaptations for virtual learning.

Other variations include personalised learning paths, community engagement, peer-led activities, family involvement, diverse assessment methods, and the incorporation of art and creativity. These adaptations provide flexibility to meet individual student needs and foster a more inclusive and relevant emotional intelligence training program within diverse educational settings.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

Means of assessing the skill acquisition via tool include:

- **Pre-and-Post Surveys:** Run initial and final surveys to assess changes in students' emotional intelligence and empathy.
- **Classroom Observations:** Set up scheduled observations to evaluate how well EI tools have been integrated into STEM education.
- **Student Self-Assessments and Peer Evaluations:** Incorporate self-assessments and peer reviews to provide a rounded understanding of each student's development.

GUIDE FOR EDUCATORS

Steps for Integrating the Emotional Intelligence **Tool** into STEM Education

01 | Research and Discovery

- Research various EI tools and identify what best suits STEM student's needs. An example can be found here Emotional Intelligence Course (theknowledgeacademy.com) or for a non-technology based alternative Mood Meter App designed to he you build your emotional intelligence (marcbrackett.com)

02 | Selection and curation

- Choose EI tools and programmes that can be easily integrated into the existing STEM curriculum.

03 | Lesson integration

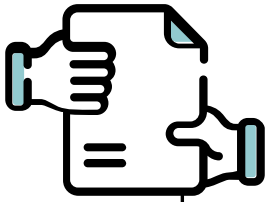
- Incorporate EI topics into regular STEM lessons using techniques like interactive lectures and role-playing.
- Make sure to have the necessary equipment!

04 | Student engagement

- Use group activities and guest speakers to keep students interested and involved in learning EI principles.

06 | Project assignment

- Assign projects that combine technical skills and EI elements, assessing both areas for a well-rounded education.
- You can propose a scenario for the students to work on



07 | Review and feedback

•Have a brief chat after the activity to gauge students' understanding and thoughts on emotional intelligence.

•Peer Review with Educators. Talk to fellow teachers who've used the activity to discuss its effectiveness and possible improvements.

08 | Iterate and Enhance

- Based on feedback, make necessary adjustments to the lesson plan or teaching methodology.

TOOL DESCRIPTION + ITS RELEVANCE

"Every individual matters. Every individual has a role to play. Every individual makes a difference."
— Jane Goodall

Role-playing involves students assuming different perspectives and engaging in interactive scenarios that mirror real-life situations.

This tool is relevant for teaching **emotional intelligence** and **empathy** by allowing students to experience and understand emotions, perspectives, and reactions in a controlled environment.

WHEN TO USE THE TOOL + HOW TO INTEGRATE IT INTO LESSON PLANS

It can be integrated at the beginning of a course, semester, or when teaching subjects that involve interpersonal interactions, problem-solving, or ethical dilemmas.

LEARNING OUTCOMES

By using Role Playing, students will be able to:

- Develop greater self-awareness of their emotions and reactions.
- Enhance their ability to understand and empathize with diverse perspectives.
- Improve communication skills, active listening, and effective expression of emotions.
- Practice ethical decision-making and navigating complex interpersonal situations.
- Cultivate teamwork and collaborative problem-solving abilities.

TEACHING METHODS USED

To implement Role Playing effectively, the following teaching methods can be used:

- **Scenario creation:** Design realistic scenarios that reflect emotions and dilemmas relevant to STEM contexts.
- **Role assignments:** Assign roles or characters to students, encouraging them to embody different perspectives.
- **Facilitated discussion:** Lead post-role-play discussions to reflect on emotions, reactions, and lessons learned.
- **Peer feedback:** Encourage students to provide constructive feedback on their peers' role-playing performances.

SPECIFIC RESOURCES/EQUIPMENT USED

- Scenario cards: Written prompts that outline the situation, roles, and objectives.

TARGET AUDIENCE (their characteristics and level)

The target audience will be STEM students of various programs and at different semesters in their studies.
Some of their specific characteristics could be:

- Varied levels of prior knowledge and experience.
- Different learning styles and preferences.
- Diverse backgrounds and interests.

ADVANTAGES + DISADVANTAGES OF THE TOOL

Advantages of the Role-Playing tool:

- Hands-on learning of emotional intelligence in realistic contexts.
- Active engagement fosters deeper understanding and retention.
- Provides a safe space for practicing interpersonal skills.
- Encourages creativity and critical thinking.

Disadvantages of the Role-Playing tool:

- It may be uncomfortable for some students to role-play in front of peers.
- Scenarios may not cover the entire spectrum of real-life situations.
- Requires careful facilitation to ensure productive discussions and reflections.

POSSIBLE VARIATIONS + ADAPTATIONS TO THE TOOL

The Role-Playing tool can be adapted to suit the specific needs and preferences of the students and teachers. Some possible variations include:

- Simulations: Extend role-playing into longer and more complex simulations.
- Digital role-playing: Use online platforms for virtual role-playing scenarios.
- Scripted role-playing: Provide students with scripted dialogues to enact.

MEANS OF ASSESSING THE SKILL ACQUISITION VIA TOOL

When assessing the acquisition of emotional intelligence & empathy through Role Playing, the following assessment methods can be considered:

- **Peer evaluations:** Students assess each other's role-playing performances.
- **Reflection papers:** Students write reflections on their role-playing experiences and lessons learned.
- **Group discussions:** Facilitate discussions where students analyse emotions, decisions, and outcomes of role-playing scenarios.

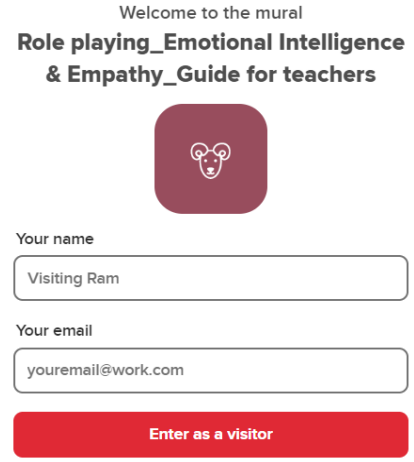
GUIDE FOR EDUCATORS

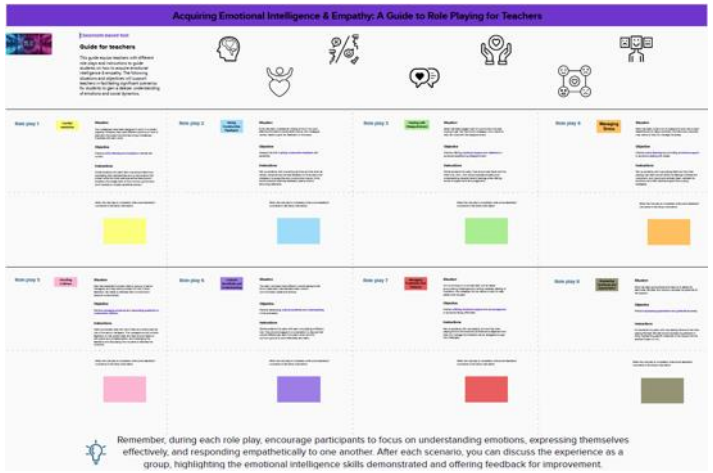
Steps for Integrating the **Role Playing SMART Goals Tool** into STEM Education

01 | Accessing Mural

- Go to MURAL by clicking on https://app.mural.co/t/aceeu4992/m/aceeu4992/1690441719164/7e1f64ee62d34386a066f50cbfd3c7c6579c4a5b?sender=u33007655b058e0c372fb0249
- Input your name and email to visualise the tool.

ENTER YOUR INFORMATIO N HERE





THIS IS HOW THE TOOL LOOKS

02 | Introduction to the tool

- Read the description on the top left corner, which will assist you in leading your students through each role play.

03 | Conflict resolution role play

- Navigate to role play 1 on the Mural and read the description of the situation involving conflicting colleagues.
- Focus on the objective of practicing active listening and empathy.
- Divide students into pairs, allowing them to take turns expressing perspectives and concerns, actively listening, and finding common ground for resolution.

04 | Giving constructive feedback role play

- Move to role play 2 and understand the situation of providing feedback to a colleague.
- Emphasise the objective of developing the skill of giving feedback with sensitivity.
- Pair up students and assign them roles, where one gives constructive feedback and the other receives it openly.

05 | Dealing with disappointment role play

- Go to role play 3 and focus on the objective of practicing emotional support and validation.
- Divide students into pairs, allowing one to play the role of the disappointed individual and the other to provide empathy and support.

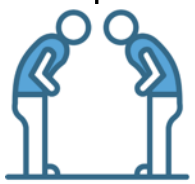
06 | Managing stress role play

- Proceed to role play 4 and understand the situation of helping a colleague under stress, making emphasis on practicing active listening and emotional support.
- Pair up students, assigning one to share stress while the other actively listens, validates emotions, and offers coping strategies.

07 | Handling criticism role play

- Move to role play 5 and read about addressing criticism and responding constructively.
- Focus on the objective of managing emotions and responding positively.
- Assign one student to handle criticism while others play the roles of senior managers providing feedback.

08 | Cultural sensitivity role play



- Go to role play 6 and understand the situation of bridging cultural differences in a team.
- Focus on the objective of developing cultural sensitivity and understanding.
- Pair up students, encouraging conversations to learn from different cultural backgrounds and find common ground.

09 | Managing frustration role play

- Proceed to role play 7 and read about supporting a colleague facing frustration.
- Make emphasis on the objective of offering emotional support and encouragement.
- Pair up students, where one plays the frustrated individual and the other provides patience and encouragement.

10 | Expressing gratitude role play

- Move to role play 8 and understand the situation of expressing gratitude and appreciation.
- Focus on the objective of practicing sincere gratitude expression.
- Assign roles to students, allowing one to convey gratitude while the other receives it.

11 | Facilitating role play discussions

- After each role play, encourage participants to discuss their experiences.
- Highlight emotional intelligence skills demonstrated and offer feedback.
- Facilitate group conversations focusing on understanding emotions, effective expression, and empathetic responses.

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