

# STE(A)M IT INTEGRATED LESSON PLAN TEMPLATE

## Title

How to create a green energy swimming pool?

## Authors

Karolina Brleković (Mathematics and physics teacher)

Snježana Damjanović

Sonja Šumonja

## Summary

Recreation time is very important in a person's life. Physical activity affects health. Yet the lack of time to leave and arrive from the gym, recreation center, etc. is often a factor that influences us not to recreate enough. Is it possible to make your own pool? Besides from the price, how does the pool affect the environment and what is needed for our pool to be environmentally friendly?

The whole project was conceived as an entrepreneurial idea.

Project requires teamwork. Communication and collaboration are important in any project. Project team members must present their ideas and solutions to clients and use digital tools to do so. Students will work in this project in four teams, as employees of a pool construction and maintenance company.

The first team has the task to research the colors for swimming pools, choose the optimal color of harmless, and offer the customer three options. The buyer chooses the optimal offer.

The other team is tasked with researching pool covers when the pool is not in use. They will make three offers depending on the material and color used in making it. The buyer chooses the optimal offer.

The third team is tasked with exploring ways to maintain pool water quality. The options available to the third team are a) quality maintenance chemicals and b) filtration system. The third team must offer the buyer the optimal offer for option a) and the optimal offer for option b).

The fourth team investigates: a) the issue of water consumption b) the impact on the environment with the option of heating and supplying the water purification pump with solar energy.

At the end of the project, students will prepare a presentation where they will present their offers, explain why they are good and offer the customer optimal solutions. Students will present their project on the school website.



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## Subject (s)

*Please list in detail the subjects taught in this lesson and briefly explain why specific subjects and teachers were chosen, including the link of the non-STEM subjects and their use in improving the lesson.*

**Mathematics:** *Students practice their skills by assessing and applying principles to solve questions about volume, quantity, ratio.*

**Biology/Chemistry:** *The impact of chemicals in wastewater on the ecosystem, and the impact on humans.*

**Science:** *Research on sustainable energy sources - solar pool heating and solar power of water purification pump.*

**ICT:** *Students use the tools Artificial Intelligence (Siri, Bixby, Cortana), Present the results in Creately (<https://creately.com>), software for drawing and collaboration on ideas, concepts, and processes. Use it as a charting and diagramming tool / collaboration tool / visual space. The results of the research are presented as a PowerPoint presentation and as a Wakelet collection <https://wakelet.com/>. They create the website at <https://sites.google.com>*

## Real- life questions

**How to create a green energy swimming pool?**

**How do chemicals in the pool affect human health?**

**Can a sustainable energy source be used to heat and clean the pool?**

**How to collect the best offers?**

**Is it the most favorable also the best solution?**

## Aims of the lesson

*Knowledge application (students are expected to demonstrate sound understanding of how the selected subjects are used and linked between them).*

- ***Students are divided into teams, the goal is to develop skills such as: teamwork, entrepreneurial skills, data processing and analysis of results, development of critical thinking of students (according to data obtained on the Internet) as well as all information.***
- ***Development of digital skills, intercultural relationship of physics, chemistry, biology and mathematics subjects and non-STEM subjects such as entrepreneurship!***
- ***Development of aesthetic competence.***
- ***Development of an ecological approach using technology and mathematical knowledge.***



### Connection to STEM careers

*How the skills developed by this lesson connect to existing and perspective STEM careers. Students are expected to demonstrate (while working in groups or other) how the chosen subjects are linked to STEM careers and list some potential career paths.*

*These activities give pupils insight in complex work that is not possible to do it alone.*

*Working in a team is something that we need today.*

*Some of potential career are:*

- solar engineer
- ecological planner
- chemistry engineer
- ICT planner

### Age of students

15- 19 years old

### Time

Teaching time:

- Preparation: 60 minutes
- STEM Subject 1 - Mathematics: 180 minutes
- STEM Subject 2 – Science (Biology/Chemistry/Physics): 310 minutes
- STEM Subject 3 - ICT/: 145 minutes
- STEM Subject 4/non-STEM subject Economy: 145 minutes

### Teaching resources (material & online tools)

*Materials: Solar lab, chemistry lab - if it is possible. If not, all can be done virtually*

*Online tools: Virtual labs: <https://www.vlab.co.in/>, Siri: <https://www.apple.com/siri/>, Cortana: <https://www.microsoft.com/en-us/cortana>, YouTube: <https://youtu.be/a0YCthRsN8c>, Creately: <https://creately.com/>, Wakelet: <https://wakelet.com/>, Canva: [https://www.canva.com/design/DAEOPjbOigM/v4wccHzwvI\\_eRpTcUfKBuA/view?utm\\_content=DAEOPjbOigM&utm\\_campaign=designshare&utm\\_medium=link&utm\\_source=publishsharelink](https://www.canva.com/design/DAEOPjbOigM/v4wccHzwvI_eRpTcUfKBuA/view?utm_content=DAEOPjbOigM&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink)  
Google sites: <https://sites.google.com>, Microsoft excel: <https://www.microsoft.com/en-us/microsoft-365/excel> Price calculator: <https://www.calculatorsoup.com/calculators/financial/price-calculator.php>*

*Formal assessment tasks:*

*Wizer: <https://app.wizer.me/preview/65NBSN>*

### 21<sup>st</sup> century skills

*How the lesson plan corresponds to 21<sup>st</sup> century skills. To find out more: <http://www.p21.org/our-work/p21-framework>*

*This lesson plan will enhance among the students the following skills, defined as 21<sup>st</sup> century skills:*

*Learning and innovation skills 4c's: Critical thinking, collaboration, communication, creativity*

*Technology skills: Use of ICT, analysis and create media.*

*Social skills: Students work in teams, give, and respond to feedback.*



## Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, IBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

| Name of activity                                      | Procedure  | Time |
|---|--|------|
| <b>1<sup>st</sup> Lesson</b>                          |  |      |
| <b>Brainstorming and discussion</b>                   | <p>What is connection between swimming pool and mathematics?</p> <p>Do we need green energy when we start with building swimming pool?</p> <p>What we do with wastewater?</p> <p>Chemicals in pool, are they dangerous for human health?</p> <p>Presentation of the tasks for pupils:</p> <p>What will we investigate?</p>   | 30'  |
| <b>Discussion and preparation for the next lesson</b> | <p>Dividing in four groups:</p> <p>The first team has the task to research the colors for swimming pools, choose the optimal color of harmless, and offer the customer three options. The buyer chooses the optimal offer.</p> <p>The other team is tasked with researching pool covers when the pool is not in use. They will make three offers depending on the material and color used in making it. The buyer chooses the optimal offer.</p> <p>The third team is tasked with exploring ways to maintain pool water quality. The options available to the third team are a) quality maintenance chemicals and b) filtration system. The third team must offer the buyer the optimal offer for option a) and the optimal offer for option b).</p> <p>The fourth team investigates: a) the issue of water consumption b) the impact on the environment with the option of heating and supplying the water purification pump with solar energy.</p> | 30'  |
| <b>2<sup>nd</sup> Lesson</b>                          |  |      |
| <b>STEM Subject 1</b>                                 | Mathematics  | 180' |



| Name of activity                   | Procedure   | Time |
|------------------------------------|---|------|
| <b>Introduction</b>                | About swimming pool dimension? What is the connection between solid volume and amounts of water in a pool? Can we optimize useful surfaces and amount of water?   | 10'  |
| <b>Investigate</b>                 | Pupils are investigating about volume of solids.  | 15'  |
| <b>Group work</b>                  | In groups each team work on poster about volume of solids.  | 65'  |
| <b>Creativity, Produce</b>         | Each group will produce one suggestion about dimension of swimming pool. They will create their model in GeoGebra.  | 45'  |
| <b>Presentation and discussion</b> | Every group will present model. Together they will decide on what model they will continue to work.   | 25'  |
| <b>Calculation</b>                 | Area and volume calculation of the model  | 20'  |
| <b>2<sup>nd</sup> Lesson</b>       |   |      |
| <b>STEM Subject 2</b>              | Science   | 310' |
| <b>Introduction</b>                | <p>Exploring ways to maintain pool water quality.</p> <p>The options available are:</p> <ul style="list-style-type: none"> <li>a) quality maintenance chemicals and</li> <li>b) filtration system.</li> </ul> <p>Exploring:</p> <ul style="list-style-type: none"> <li>a) the issue of water consumption</li> <li>b) the impact on the environment with the option of heating and supplying the water purification pump with solar energy.</li> </ul> | 10'  |
| <b>Investigate</b>                 | <p>Pupils are investigating in four teams:</p> <ul style="list-style-type: none"> <li>a) water consumption in two option – with mechanical filter or with chemicals</li> <li>b) Price comparison of chemicals and filters</li> <li>c) Investigation of possibilities for using solar panels for heating and supplying water purification pump.</li> <li>d) What chemicals we use in swimming pools?</li> </ul>  | 60'  |
| <b>Learning/Watching</b>           | <p>Pupils are learning about:</p> <ul style="list-style-type: none"> <li>- Solar energy in Solar lab</li> <li>- Chemicals in swimming pools</li> </ul>  | 180' |



| Name of activity                   | Procedure   | Time |
|------------------------------------|---|------|
|                                    | <ul style="list-style-type: none"> <li>- Ecology – is there a problem with chemicals on human health.</li> </ul> <p>We will have guests from University for each question.</p>  |      |
| <b>Calculation</b>                 | <ul style="list-style-type: none"> <li>- amount of water</li> <li>- amount of chemicals in one year</li> <li>- amount of electricity in one year</li> <li>- how many chemicals remain in the human body in one year if bathed 3 times a week in a pool</li> </ul> <p>Guests from University will help groups.</p>   | 30'  |
| <b>Presentation and discussion</b> | Every group will present their work and conclusions.  | 30'  |
| <b>3<sup>rd</sup> Lesson</b>       |   |      |
| <b>STEM Subject 2</b>              | <b>ICT</b>  | 145' |
| <b>Read/Watch/Listen</b>           | The teacher handed out learning scenarios to the students. After the students have looked at the script, the teacher explains how to work on the project and what the ultimate goal of the script is.   | 10'  |
| <b>Discuss</b>                     | The teacher and students talk briefly to get acquainted with the learning scenario and what tools they will use to realize the scenarios.   | 10'  |
| <b>Investigate</b>                 | Using Artificial Intelligence <a href="https://youtu.be/a0YCthRsN8c">https://youtu.be/a0YCthRsN8c</a> , students explore the best way to implement a project.   | 15'  |
| <b>Collaborate</b>                 | The teacher divided the students into 4 groups. Each group has one research topic: 1. Pool painting 2. Pool cover 3. Optimal pool water quality 4. Solar energy efficiency Each group was given detailed instructions related to their research task. Students actively explore their topic. The teacher monitors the work of the groups and supports the work in groups. | 10'  |
| <b>Creativity, Produce</b>         | Students draw a pool together in the Creately tool <a href="https://createely.com/">https://createely.com/</a> . Then they create a digital board for each team. Each team will post ideas, implementation steps and research results on their digital board. Each team will be able to see at what stage his team is, but also other teams.                              | 10'  |
| <b>Product</b>                     | Students work in groups, and each group should work on a given topic. Each group will post a video on the topic, a photo, an article and their thoughts on their digital board.   | 10'  |
| <b>Practice</b>                    | Each group presents its task and interesting learned elements. They present their digital board and explain to the rest of the  | 20'  |



| Name of activity             | Procedure  | Time |
|------------------------------|--|------|
|                              | class what is relevant to their topic, concepts, practice examples, and similarities with other topics in the class. In this activity, students listen to their peers and present in PowerPoint, while the teacher monitors the work of each group. Students present their results in a detailed collection created in the Wakelet <a href="https://wakelet.com/">https://wakelet.com/</a> tool. At the end of the lecture, all teams will create a joint collection.  |      |
| <b>Product</b>               | Students jointly create an article for the school website, which is created in the Google Sites <a href="https://sites.google.com">https://sites.google.com</a> tool. The article will describe the whole process of working on the project and the results they came to. The students also made a promo leaflet in Canva<br><br><a href="https://www.canva.com/design/DAEOPjbOigM/v4wccHzwvl_eRpTcUfKBuA/view?utm_content=DAEOPjbOigM&amp;utm_campaign=designshare&amp;utm_medium=link&amp;utm_source=publishsharelink">https://www.canva.com/design/DAEOPjbOigM/v4wccHzwvl_eRpTcUfKBuA/view?utm_content=DAEOPjbOigM&amp;utm_campaign=designshare&amp;utm_medium=link&amp;utm_source=publishsharelink</a> | 20'  |
| <b>Practice</b>              | The teacher takes a short quiz and explains the concepts if there is any ambiguity. The students solve individually. The quiz is about the different practices that each group exhibited and generated online through the Wizer <a href="https://app.wizer.me/preview/65NBSN">https://app.wizer.me/preview/65NBSN</a> tool. Students will need to use cell phones to answer questions. Wizer data will immediately show the teacher where there are weaknesses in the realized topics. Students will look at their own data and create additional quiz questions and answers in areas where they are weak.   | 10'  |
| <b>Discuss/Read/Practice</b> | All students, each individually evaluate their peer. The teacher will remind students of the elements of peer assessment and help students focus on the essentials. The teacher will also be reminded how to provide feedback to peers, with concrete positive examples from the lesson. Later, students will evaluate the collaboration and contribution to the discussion. Each student will receive a template to evaluate their peers and constructive and positive feedback.<br><a href="https://drive.google.com/file/d/1YoNv_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing">https://drive.google.com/file/d/1YoNv_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing</a>                                   | 15'  |
| <b>Discuss</b>               | Lesson Conclusion: The teacher will ask students for discussion with encouraging questions- what have they learned new? What surprised them? Why do they think so? What are the differences and similarities between the topics? He will perform this final exercise by writing to each student: 1 new thing he has learned, 1 surprising thing, 1 similarity and 1 difference. Students will read notes from their friends.   | 15'  |



| Name of activity                | Procedure   | Time |
|---------------------------------|---|------|
| Learning products               | If you wish to share more materials that complement the text, please include them in the Annexes section and refer to them in this section as well.   |      |
| 4 <sup>th</sup> Lesson          |   |      |
| STEM Subject 3/non-STEM subject | Economy   | 145' |
| Read/Watch/Listen               | The teacher handed out learning scenarios to the students. After the students have looked at the scenarios, the teacher explains how to work on the project and what the ultimate goal of the lesson is.  | 10'  |
| Discuss                         | The teacher and students talk briefly to get acquainted with the learning scenario and what digital tools will be used to realize the scenario.   | 10'  |
| Investigate                     | Using Artificial Intelligence <a href="https://youtu.be/a0YCthRsN8c">https://youtu.be/a0YCthRsN8c</a> , students explore the best way to implement a project. In doing so, they explore the best tools for implementation.  | 15'  |
| Collaborate                     | The teacher divided the students into 4 groups. Each group has one task:<br><br>1. Present the three best offers for pool painting. The bids will be compiled on the basis of data obtained from the ICT group, which was tasked with researching this topic.<br><br>2. Introduce the three best pool cover deals. The bids will be compiled based on data obtained from the ICT group, which was tasked with researching this topic.<br><br>3. Present the three best offers for maintaining optimal pool water quality. The bids will be compiled on the basis of data obtained from the ICT group, which was tasked with researching this topic.<br><br>4. Present the possibilities of solar energy efficiency. The possibilities will be compiled based on data obtained from the ICT group, which was tasked with researching this topic. | 10'  |





| Name of activity           | Procedure  | Time |
|----------------------------|--|------|
|                            | Each group was given detailed instructions related to their economic task. The teacher monitors group work and supports group work.  |      |
| <b>Creativity, Produce</b> | Students use the Creately tool <a href="https://creately.com/">https://creately.com/</a> together. They review each digital board of the ICT team and record the results obtained by the ICT team. Each team will compile three best offers for their task at <a href="https://www.microsoft.com/en-us/microsoft-365/excel">https://www.microsoft.com/en-us/microsoft-365/excel</a> . Each team will be able to see at what stage his team is, but also other teams.   | 10'  |
| <b>Product</b>             | Students work in groups, and each group should work on a given topic. Each group will publish three offers on a given topic, a photo, an article and their thoughts on their digital board.  | 10'  |
| <b>Practice</b>            | Each team presents its task, the three best offers and interesting learned elements. They represent an offer made in Microsoft Office <a href="https://www.microsoft.com/en-us/microsoft-365/excel">https://www.microsoft.com/en-us/microsoft-365/excel</a> tools, and an online calculator <a href="https://www.calculatorsoup.com/calculators/financial/price-calculator.php">https://www.calculatorsoup.com/calculators/financial/price-calculator.php</a> . Each team explains to the rest of the class what is relevant to their topic, concepts, examples of practice, and similarities with other topics in the class. In this activity, students listen to their peers and introduce themselves in PowerPoint, while the teacher monitors the work of each group. Students present their results in a detailed collection created in the Wakelet tool <a href="https://wakelet.com/">https://wakelet.com/</a> . At the end of the lecture, all teams will create a joint collection. | 20'  |
| <b>Product</b>             | Students work together to create a financial article for a school website created on Google Sites <a href="https://sites.google.com">https://sites.google.com</a> . The article will describe the entire process of working on the project, creating the best bids and presenting those bids.  | 20'  |
| <b>Practice</b>            | The teacher takes a short quiz and explains the concepts if there is any ambiguity. The students solve individually. The quiz is about the different practices that each group exhibited and generated online through the Wizer <a href="https://app.wizer.me/preview/65NBSN">https://app.wizer.me/preview/65NBSN</a> tool. Students will need   | 10'  |



| Name of activity             | Procedure  | Time |
|------------------------------|--|------|
|                              | to use cell phones to answer questions. Wizer data will immediately show the teacher where there are weaknesses in the realized topics. Students will look at their own data and create additional quiz questions and answers in areas where they are weak.  |      |
| <b>Discuss/Read/Practice</b> | All students, each individually evaluate their peer. The teacher will remind students of the elements of peer assessment and help students focus on the essentials. The teacher will also be reminded how to provide feedback to peers, with concrete positive examples from the lesson. Later, students will evaluate the collaboration and contribution to the discussion. Each student will receive a template to evaluate their peers and constructive and positive feedback.<br><a href="https://drive.google.com/file/d/1YoNv_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing">https://drive.google.com/file/d/1YoNv_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing</a> | 15'  |
| <b>Discuss</b>               | Lesson Conclusion: The teacher will ask students for discussion with encouraging questions- what have they learned new? What surprised them? Why do they think so? What are the differences and similarities between the topics? He will perform this final exercise by writing to each student: 1 new thing he has learned, 1 surprising thing, 1 similarity and 1 difference. Students will read notes from their friends.   | 15'  |
| <b>Learning products</b>     | <i>If you wish to share more materials that complement the text, please include them in the Annexes section and refer to them in this section as well.</i>   |      |

## Assessment

A final project will be done from all groups of students explaining the procedure that they have done for the whole Learning Scenario with all experimental data and graphs that they must implement. Groups have opportunity to present work in different ICT tools.



### Initial assessment

Posters and conclusion after every Lesson

### Formative evaluation

Wizer: <https://app.wizer.me/preview/65NBSN>

### Final assessment

Projects

### Student feedback

[https://drive.google.com/file/d/1YoNv\\_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing](https://drive.google.com/file/d/1YoNv_SqQ0HYZen651vHVLN-ZwQ7yu1V5/view?usp=sharing)

### Teacher feedback

The teachers are expected to provide feedback on how the lessons were received and implemented.

| COMPONENTS                             | LEVELS OF REALIZATION OF CRITERIA   |   |   |
|--|---|---|---|
|  | 3 points  | 2 points  | 1 point   |
| Work plan                              | All activities carried out are clearly described with the above procedure.  | The activities are described, but without precisely described implementation procedures.            | The activities are partially described with an incomplete procedure.  |
| Mathematical calculation               | Accurately and in detail presented calculation for all three tasks.   | Accurate, but not detailed calculation for all three tasks.   | Results shown, but without calculation.   |
| data processing and display of results | The results are systematically processed and accurately, clearly and creatively presented (tabular, graphical and / or pictorial) with an explanation of the selection. | The results are well processed but not clearly presented. The selection is not clearly stated.      | The results have not been processed and the presentation is unclear and / or unreadable and / or illegible.                                       |
| Conclusion and review of the work      | The conclusion is clearly written and follows from the results obtained. It contains a review of the task (possible errors and / or suggestions for improvement).       | The conclusion stems in part from the results obtained. It contains a partial overview of the task. | The conclusion is too general and does not follow from the obtained results and / or misinterpret them. It does not contain a review of the task. |



|                    |   |   |   |
|--------------------|---|---|---|
| Sources of offers  | All offers are listed in detail.  | The offers are listed in detail, but one offer is missing.  | Three offers are not listed.  |
| Paper presentation | The paper is presented clearly and systematically. Mathematical notations and graphs were used. The work is visually appealing with the use of sketches, photographs, illustrations, but it is not burdened with superfluous distracting details. | The paper is presented clearly, but insufficiently systematically. Mathematical notations and graphs were partially used. The work is visually appealing with the use of sketches, photographs and illustrations, but is burdened with superfluous distracting details. | The paper is not presented clearly and systematically. No mathematical notations or graphs were used. The work is visually poor and does not contain sketches and depictions. |



## Annexes

A thorough and complete list of all the materials used will be asked from all teachers. Those materials will be cited as Annexes and they can be further cited in the learning scenario.

