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## STEAME ACADEMY

### TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2

#### SERVICE TEACHERS: "FOUR TRIANGLE CENTRES AND THE EULER LINE"

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#### 1. Overview

|                                |   |                               |                             |
|--------------------------------|---|-------------------------------|-----------------------------|
| Title                          | Four triangle centres and the Euler Line  |                               |                             |
| Driving Question or Topic      | Four notable centers of the triangle: Incenter, Barycenter, Circumcenter and Orthocenter. Explore its properties using GeoGebra and Milage Learn + APP  |                               |                             |
| Ages, Grades, ...              | 12-15   | 7th to 9th grade              |                             |
| Duration, Timeline, Activities | 16 learning hours   | Eight 60 minute class periods | <i>Number of activities</i> |
| Curriculum Alignment           | <p>With this activity we intend to deepen knowledge of the properties of the notable centers of the triangle: Incentre, Barycenter, Circumcenter and Orthocenter. These points have been known since ancient Greece, but many of their properties are surprising and little known.</p> <p>Student teachers should review the definitions of the aforementioned notable centers and the tutorials on using APP Milage Learn + and Geogebra.</p> <p>Knowledge about notable centers is reviewed with tasks included in the Milage APP.</p> <p>Teachers will also carry out some activities and their results will be confirmed with Geogebra.</p> |                               |                             |
| Contributors, Partners         |   |                               |                             |
| Abstract - Synopsis            |   |                               |                             |
| References, Acknowledgements   | <a href="https://faculty.evansville.edu/ck6/encyclopedia/ETC.html">https://faculty.evansville.edu/ck6/encyclopedia/ETC.html</a>   |                               |                             |

#### 2. STEAME ACADEMY Framework\*

|                                   |  |                                  |
|-----------------------------------|--|----------------------------------|
| Teachers' Cooperation             | Teachers should jointly investigate the properties of the notable centers of the triangle.<br>The concept of center of gravity and its importance in engineering should also be discussed. | <i>Teacher 1<br/>different a</i> |
| STEAME in Life (SiL) Organization | Provide teachers with tools to explore the applications of elementary geometry to engineering and architecture.  | <i>Meeting w<br/>Entreprene</i>  |
| Action Plan Formulation           | STAGE I: Preparation Parts 1 and 2,<br>STAGE II: Action Plan Formulation: Part 3,<br>STAGE III: Final individual work: Part 4.   | <i>Reference<br/>Project-ba</i>  |

### 3. Objectives and Methodologies

|  |  |   |
|--|--|---|
| Learning Goals and Objectives                  | <p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>- Definition and main properties of Incentre, Barycentre, Circumcentre and Orthocentre.</li> <li>- Euler's Line</li> <li>- Other centres of the triangle.</li> </ul> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>- Construct the Incentre, the Barycentre, the Circumcentre, and the Orthocentre.</li> <li>- Deduce some of its properties.</li> <li>- Finding the center of gravity of a triangle.</li> <li>- Construct the Euler's Line</li> <li>- Use the Clark Kimberling's Encyclopedia of Triangle Centers.</li> </ul> <p><b>Attitudes</b></p> <ul style="list-style-type: none"> <li>- Appreciate the real-world implications of geometry.</li> <li>- Collaborate effectively in group activities, contributing ideas and sharing findings.</li> <li>- Recognize the value of interdisciplinary knowledge, integrating math, engineering, and technology in understanding of geometric properties.</li> </ul>  | <p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>- De</li> <li>Or</li> <li>- Eu</li> <li>- Ot</li> </ul> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>- Co</li> <li>Or</li> <li>- De</li> <li>- Fir</li> <li>- Co</li> <li>- Us</li> </ul> <p><b>Attitudes</b></p> <ul style="list-style-type: none"> <li>- Ap</li> <li>- Co</li> <li>fin</li> <li>- Re</li> <li>en</li> </ul> |
| Learning Outcomes and expected Results         | <ol style="list-style-type: none"> <li>1. Review knowledge of some elementary geometry topics.</li> <li>2. Discover other notable points associated with triangles.</li> <li>3. Highlight collinearity and proportionality relationships.</li> </ol> <p>Provide tools to explore the applications of elementary geometry to engineering and architecture.</p>  | Definition  |
| Prior Knowledge and Prerequisites              | <p>Trainees must master:</p> <ul style="list-style-type: none"> <li>- The concepts of bisector, perpendicular bisector, height and median of a triangle.</li> <li>- The notion of Incenter, Barycentre, Circumcentre and Orthocentre.</li> </ul> <p>The definition of inscribed circumference and the definition of circumscribed circumference.</p>   | Prior exper<br>this learni  |
| Motivation, Methodology, Strategies, Scaffolds | <p>The teaching methodology for this lesson plan involves a combination of tutorial videos, discussions, hands-on activities, and group work to ensure a deeper understanding of geometric properties of triangles.</p> <ol style="list-style-type: none"> <li>1. Tutorial Videos: Tutorial videos will be shown on the notable centres of the triangle, the use of Milage Learn + app and the Geogebra software.</li> <li>2. Hands-on Activities: Solving worksheets in Milage Learn + app.</li> <li>3. Group Work: The collaborative activity, where teachers consult the Clark Kimberling's Encyclopaedia, find other centres in the triangle, and study its main properties.</li> <li>4. Presentations: The culminating group presentations provide an opportunity for students to showcase their understanding of the geometry of the triangles and articulate their findings to their peers.</li> <li>5. Reflection and Discussion: Throughout the sessions, moments for reflection and open discussions are included to encourage critical thinking, allowing students to consolidate their learning and share perspectives.</li> </ol> <p>This blended approach combines theoretical concepts with practical applications, fostering an engaging and comprehensive learning experience for the student teachers.</p> | Teaching a<br>achieving<br>developme<br>Instruction<br>representa<br>Active stud<br>techniques  |

## 4. Preparation and Means

|  |  |
|--|--|
| Preparation, Space Setting, Troubleshooting Tips   | <i>Procedures, spaces, and material preparation<br/>Setting in classroom, outdoor activity, computer lab, hybrid environment, etc.</i> |
| Resources, Tools, Material, Attachments, Equipment | <i>Instructional sources and digital material with the related references needed for the implementation of the learning plan</i>       |
| Health and Safety                                  | There are no particular safety measures required by this L&C Plan.   |

## 5. Implementation

|   |  |
|---|--|
| Instructional Activities, Procedures, Reflections | <p><b>Part 1 – Preparation</b><br/>The teachers watch a video about the four notable centers of the triangle and consults tutorials on using Milage Learn + and Geogebra.</p> <p><b>Part 2</b><br/>the teachers solves a worksheet inserted in the MILAGE application. The objective of this sheet is to analytically verify some of the properties of these 4 notable centers.</p> <p><b>Part 3</b><br/>The teachers must construct the 4 notable centres in Geogebra. They must confirm that 3 of these centres: Barycentre, Circumcentre and Orthocentre are collinear (Euler's Line). Teachers should review the concept of centre of gravity. The teachers must also check that the distance from the Barycentre to the Orthocentre is twice of the distance between the Barycentre and the Circumcentre. Note that the Incentre belongs to Euler's Line only when the triangle is isosceles.</p> <p><b>Part 4 - Final group work</b><br/>The teachers search in the Clark Kimberling's Encyclopaedia for other centres of the triangle and related lines. Student teachers must build a Geogebra file, with the properties explored.</p> |
| Assessment - Evaluation                           | <i>Assessment and formative evaluation processes and rubrics to measure the student's ability to perform what was described in the objectives</i>  |
| Presentation - Reporting - Sharing                | <i>Documents, outputs, artifacts, products produced by the students with references, web links etc., for sharing to media</i>  |
| Extensions - Other Information                    |  |

# Resources for the development of the STEAME ACADEMY Learning and Creativity Plan Template

## In the case of learning through project-based activity

### STEAME ACADEMY Prototype/Guide for Learning & Creativity Approach Action Plan Formulation

*Major steps in the STEAME learning approach:*

#### **STAGE I: Preparation by one or more teachers**

1. Formulating initial thoughts on the thematic sectors/areas to be covered
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.

#### **STAGE II: Action Plan Formulation (Steps 1-18)**

##### Preparation (by teachers)

1. Relation to the Real World – Reflection
2. Incentive – Motivation
3. Formulation of a problem (possibly in stages or phases) resulting from the above

##### Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. Background Creation - Search / Gather Information
5. Simplify the issue - Configure the problem with a limited number of requirements
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
8. Observation-Experimentation - Initial Conclusions
9. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
10. Gathering of results / information based on points 7, 8, 9
11. First group presentation by students

##### Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. Configure STEAME models to describe / represent / illustrate the results
13. Studying the results in 9 and drawing conclusions, using 12
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)

##### Review (by teachers)

15. Review the problem and review it under more demanding conditions

##### Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions

## STAGE III: STEAME ACADEMY Actions and Cooperation in Creative Projects for school students

**Title of Project:** \_\_\_\_\_

Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

| <b>STAGE</b> | <b>Activities/Steps</b><br>Teacher 1(T1)<br>Cooperation with T2<br>and student guidance | <b>Activities /Steps</b><br><b>By Students</b><br>Age Group: ____ | <b>Activities /Steps</b><br>Teacher 2 (T2)<br>Cooperation with T1 and<br>student guidance |
|--------------|---|---|---|
|              |   |   |   |
| A            | Preparation of steps 1,2,3  |   | Cooperation in step 3   |
| B            | Guidance in step 9  | 4,5,6,7,8,9,10  | Support guidance in step 9  |
| C            | Creative Evaluation   | 11  | Creative Evaluation   |
| D            | Guidance  | 12  | Guidance  |
| E            | Guidance  | 13 (9+12)   | Guidance  |
| F            | Organization (SIL)<br>STEAME in Life  | 14<br>Meeting with Business<br>representatives                    | Organization (SIL)<br>STEAME in Life  |
| G            | Preparation of step 15  |   | Cooperation in step 15  |
| H            | Guidance  | 16 (repetition 5-11)  | Support Guidance  |
| I            | Guidance  | 17  | Support Guidance  |
| K            | Creative Evaluation   | 18  | Creative Evaluation   |