The following example is a guiding format for developing a Lesson Plan in a situation of supporting the students working in the context of the INNOMATH project. This mathematical content is expected to be useful for the students in their effort for solving industrial problems.

Lesson/ Learning Plan

Topic: Specify a particular mathematical topic

Digital Geometry

Target Group: Specify age, grade level and mathematical background of the students

"Gifted" Students in a middle school at grade level 8 to 10 (2^{th} to 4^{th} year in a secondary school)

Mathematical background of the students:

Basic concepts of median, angle bisector, perpendicular bisector, heights of a triangle.

Goal/ Content/ Description: (Provide a brief description of the content of the lesson as well as the general goals in relation to the prospects of usefulness, applications and mathematical value of the particular mathematical topic.)

Geometry has many practical uses in everyday life, such as measuring circumference, area and volume, when you need to build or create something.

Geometric shapes also play an important role in common recreational activities, such as video games, sports, quilting and food design. Without geometry, engineers and architects wouldn't be able to design and construct houses, buildings, cars and tools that make life easier and more enjoyable.

The lesson plan will focus on the three fundamental Cevian lines and the circumcircle property, that all triangles can be inscribed in a circle.

Objectives: Will be able to solve some industrial problems that involves more than two constraints that can be solved using the graphical method.

General Mathematical Objectives

To develop skills for problem solving

To develop motives and positive affective tendencies for mathematics

To identify/ develop/ create applications of the related concepts and processes in the real world.

To develop mathematical skills/ through the use/ exploitation of mathematical topics or means as help/ support in modelling, calculations and representations,

To develop digital skills/ through the use/ exploitation of digital means as help/ support in calculations and representations,

To exploit the flipped classroom method for supporting the various processes.

Particular Mathematical Objectives

1. Identify and understand the meaning of locus of points.
2. Draw the median line, angle bisector, perpendicular bisector, and the perpendicular height of a point from a line using GeoGebra.

Materials/ Tools: for example ppt, use of graphing software etc.

Graphing software (eg Geogebra, Desmos)
Power Point Presentations
Youtube videos

Resources used by the teacher:

School syllabus, Geotube, youtube videos.

Resources for the student:

Articles, examples, exercises, ppt presentations, YouTube videos (eg Khan Academy) on the topic by using the Internet. For this the teacher is to prepare a list of webpages in the mother language of the students. Work sheets prepared by the teacher.

Approaches/ Methodology: Describe briefly the approaches to be used (e.g. problem solving project, flipped classroom,… ,the role of the teacher, etc)

The flipped classroom approach will be used in order to give to the student the possibility for investigation, and access of information, and watching videos demonstrating the approach and posing the concept of Cevian lines.

The project based on Digital Geometry will be utilised in order to help the students to acquire the skill to using graphic calculators to analyse solutions and draw geometrical figures.

Activities Plan:

Introductory activities (creation of interest, reference to real value issues, relation to background experiences etc)

Time When / length	Description of the activity	Instructions/ Hints/ Support/ Comments
Previous Day	Revise the concepts and how to construct, median, angle bisector, perpendicular bisector and perpendicular height using compass.	See power point 1
10 min	Present where the Cevian lines can be used in Real life. Cevian lines are the lines in a triangle that start from each vertex of the triangle and meet at a single point either inside or outside of the triangle. Those lines has many known	Discussion on the real life Cevian lines using attached handout on Appendix.

	properties where some of them will be examine by the students. Some of the most well-known Cevian lines are: ● Centroid is the point where all the medians of the triangle meet. Is the centre of mass of a triangle. ● Orthocentre is the point where all the altitudes of the triangle meet. ● Incentre is the point where all the angle bisectors of the triangle meet.	

Development activities

Time	Description of the activity	Instructions/ Hints/ Support/ Comments For the 3 Cevian lines using GeoGebra see power point notes.
10 min	**Provide the concept of the centroid** **1. Take a piece of cardboard and cut out a triangle.** **2. Next, try to balance you triangle on a pencil eraser.** **3. Think about where the trianlge's center might be and see if it works. It may take a few attempts, but there should be a point where you can balance the triangle.** **4. Try to draw medians of the point.**	**How to construct the median of the triangle.**
10 min	**Provide the concept of the incenter** **Given any triangle try to draw a circle that is a tangent to the three sides of the triangle.**	**How to construct the angle bisector.**
10 min	**Provide the concept of the orthocenter.**	**How to construct the orthocentre of a triangle**

Practicing Activities

Time When / length	Description of the activity	Instructions/ Hints/ Support/ Comments
10 min	To download GeoGebra.	
40 min	The students will draw the incentre, orthocentre and centroid of the triangle and have the chance to experience the tools of GeoGebra.	

10 min	Experience those points by changing one of the vertices of the triangle.	

Reflection and Closure

Is the incentre a point which appears always inside the triangle?

Is the centroid a point which appears always inside the triangle?

Is the orthocentre a point which appears always inside the triangle?

For which triangles is the orthocentre, incentre and centroid the same point?

Assignment for further work

Students can try to draw the circumcentre of the triangle.

Identify the relation of the orthocentre and the circumcentre of a triangle (if one point lies inside the triangle so does the other, if one point is on the side of the triangle so is the other and if one point lies outside the triangle so is the other).

Can read and construct Euler's line and the nine-point circle.

Appendix

https://sites.google.com/site/trianglecenteral/finding-the-centers-of-triangles-in-real-life

- The centroid of a triangle could be used in real life by needing to find the center of a certain area. For example someone is putting a swimming pool in the center of a community they will need to find right where the middle is.

- An example of orthocenter is the eiffel tower. They might of used the orthocenter to find where all the altitudes met while building it.

- The incenter could be used to build a clock. You wouldn't want the hands on the clock to be off centered so you would find the middle of the circle.

- Finding the circumcenter could be used when building a house. If you wanted to put a window in the middle of a wall then you could find the circumcenter to do that.