BEST PRACTICE EXAMPLES - SOLVED TASK

1. Name of the task:
   Multi-Criteria Decision Making with GIS

2. Why did you choose this task?
   GIS software is increasingly used as an analysis tool to aid decision-making processes in a variety of fields, e.g. in urban planning and environmental conservation. Using GIS, pupils get the opportunity to process big data sets and work towards a well-informed decision. During this process, pupils learn to dissect complex questions in smaller, manageable steps and they experience how GIS technology is used in an authentic professional context.

3. Subjects covered from STEAM areas:
   Technology, Arts

4. Target group (age range and size of the group):
   11-13 years, 20-30 students per group

5. Duration of the activity:
   Two lessons (2*50 min). More, if pupils have no prior experience with GIS.

6. Key words:
   GIS, map, data visualisation, MCDM, decision-making, urban planning.

7. Key sentence describing context of the activity, followed by short description (200 words):
   Using GIS software, e.g. ArcGIS Online or QGIS, pupils will execute a Multi-Criteria Decision Making analysis to find the most ideal location for a new ‘wind farm’ in the vicinity of the school.

8. Description of the activity environment, including the list of materials and tools needed:
   Student access to GIS software, e.g. ArcGIS Online of QGIS. The teacher needs to devise a set of map layers that can be modified by the pupils. These map layers should include a feature layer of the local municipality’s administrative boundaries, protected environmental areas, streets, and buildings. Other layers can be added at your own discretion. The feature layers are often available through the spatial planning department of the (local) government.

   During the activity, pupils work in groups of two on a laptop.. One of the students can open the GIS software and perform the analyses, while the other can read the instructions from their screen.

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9. Step by step, detailed description of the activity, including teaching and learning strategies:

Phase	Description	Teaching strategy	Suggested time
1	General introduction about the assignment. Pupils open the instructions and make a copy of the map layers that the teacher has prepared for them.	Divide the class in groups of two. Other phases are mostly student-led, using a step-by-step instruction manual for the pupils.	10 min.
2	Pupils start with the boundaries of the local municipality as their 'research area'. During the assignment, they will 'cut' pieces out of this area that do not comply with the requirements for a wind farm. The first step is to cut out the areas within the municipality that are protected environmental areas (e.g. Natura2000).	The first step makes use of the analysis tool 'overlay': it cuts out areas from the map that overlap each other. For this first step, all actions are described in detail in the instruction manual.	20 min.
3	The second step is to cut out the buildings from the remaining area, including a 200 meter buffer zone. Pupils will first create the buffer zone and then use the same tool as in phase 2 to cut out the buildings and the buffer from the map.	The instruction manual guides pupils through the set-up of the 'buffer' analysis tool. Scaffolding is applied in the second step: instead of providing a detailed instruction again, students are now expected to use the 'overlay' analysis tool on their own. They will need to select the appropriate settings without much details.	25 min.
4	The third step is to cut out the streets from the remaining area, including a 100 meter buffer zone.	The principle of scaffolding is applied in this phase as well. For this step, pupils only get the instruction to erase the streets including a buffer zone from the map layer. They need to select the appropriate analysis tools and sort out the settings themselves.	25 min.
5	If pupils have successfully completed the previous phases, they end up with a limited amount of appropriate sites for a wind		20 min.

	farm. One of these sites is selected by the pupils as the most ideal site for the new wind farm. They mark this site on the map and write a short report or prepare a presentation to clarify their decision.		

10. Learning objectives/competencies:
    - Divide complex tasks in small, manageable steps.
    - Make use of cartographic analysis tool.
    - Present research results in a comprehensible and convincing way.

11. Evaluation/Assessment guidelines:
    Pupils submit a short consultancy report or make a presentation, in which they clarify their decision for the wind farm site.

12. Lessons learned:
    The structure of the activity can be used for various other (local) spatial planning issues. It can be challenging to collect all the data layers. Especially, since some of the spatial planning layers get updated or retired after a while, which can render them useless for this assignment. This activity can be extended to include other STEAM areas, e.g. by giving more attention to the technical challenges regarding the construction of wind farms (engineering), or a more extensive instruction on how to make a compelling report or presentation (arts).

13. Additional information/Links:
    - Esri has an extensive online training programme to get acquainted with ArcGIS Online: https://www.esri.com/training/arcgis-online-training/
    - A lot of map layers are already available via Esri and can easily be imported via ArcGIS Online.

14. Contact person:
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