

## GeoGebra and Coding

Of course GeoGebra is a tool for doing maths - be geometry, be calculus, be statistics, or... . GeoGebra is also used for discoveries of dynamic constructions or functions which can more easily point out special properties of a group of objects, functions, ... or ideas what and how to proof e.g. concerning geometry. Teachers choose it in math lessons to visualize mathematical concepts and foster mathematical understanding. Students use it at home if it is used in the classroom.

The list of benefits for different math topics, for different age groups will be very long.

But GeoGebra also helps to get more familiar with computational thinking, a n important skills for coding. Using GeoGebra is another way to introduce in basic coding ideas than e.g. Scratch or other simple coding tools for young students.

Here are some examples of what young students (8-12) can learn concerning basic coding concepts:

**1. Creating tools:** A successful construction of a GeoGebra tool needs a clear understanding of different geometric objects i.e. basic objects and depending objects, a structured way of construction and understanding what it means to construct dynamically. For example lengths of segments play the role of variables and if there are more (different ones) they have to be used as different input objects for the tool that should be designed.

For construction of a more complex tool different basic tools are used – a concept that is used for coding, too.

**2. Using sliders:** Using sliders means a more generalized view on what you do and like to explore. It fosters the se of variables.

**3. Lists:** Lists are e.g. used to create string art and the combination of different ones requires a deep understanding. This belongs also to skills that are important for coding.

**4. Animation:** Animating points to have variation means to have a sequence of steps for the way and style of animation in mind before you start. Students –

especially the youngest ones – start with trial and error. But after some work they succeed in planned actions how to animate. This competence to work structured is also needed for all coding work.

Very often there is a combination of these 4 options in GeoGebra.

A big advantage is that results from the beginning are visual and creative rather from the beginning of each construction. To create different art work allows different and motivating approaches and comes about by repeating complex construction by transformations like reflections or translations. These effects enhance students' motivation to improve their own creations by e.g. thinking "what if ... when ..." and really foster important skills of computational thinking.

The following poster from Miles Berry and his article shows those skills.



<http://milesberry.net/2017/02/computational-thinking-and-technology/>