Lesson Plan

Module:	Nomograms for composition
Teaching Hours:	50 minutes
Grade Level/Age Range:	Grade 10-12
Brief Description:	In this lesson the nomograms are adopted as a model for function composition. We first use perception based embodied design to solve puzzles. We then mathematize this as function composition. We then move to the connection between compositions of functions (formula's) and nomograms.

Design Principles:	Inquiry			
	Situatedness			
	Digital tools			
	Embodiment			
Functional Thinking:	Input – Output			
	Covariation			
	Correspondence			
	Object			

Learning Goals:	✓ The student is able to explain how nomograms in sequence form a model for function composition.

Activities

Engage / Explore

Activity 1.
The student assignment (identical with the one in the student handout).

Take a tablet or smartphone, scan the QR code and answer the questions below: Or on a computer use this url: https://www.geogebra.org/m/kqn5ykqq

Try and solve the puzzle, connect to colored dots with the puzzle pieces. When you are up for the challenge try the hard setting.
We can think of the puzzle pieces as little nomograms. Using this point of view, explain how the input values and output values connect when we place the puzzle pieces in line.

- In this activity the students discover by playfully solving puzzles how nomograms places in sequence can map a point of a given color to another point.
- The teacher introduces the assignment and let the students explore the applet. If necessary, the teacher can clarify what is expected of the students while they make the exercises. At the end of this phase the teacher discusses the different answers the students gave in a classroom discourse.

Suggested tools/materials: Tablet
Estimated duration: 30 minutes

Explain / Extend

Activity 2.
The student assignment (identical with the one in the student handout).

Take a tablet or smartphone, scan the QR code and answer the questions below: Or on a computer use this url: https://www.geogebra.org/m/fxhvnnhp

1. Find the linear function g such that $g(f)$ is the given function. Check your answer using the nomogram.
2. Explain how the nomogram tells you if your solution is correct.

   - *In this activity the students extend their notion of composition of functions using nomograms. They will discover that a composition of two functions can be represented by two nomograms composing to a single function nomogram, that is the composition yields a single function.*
   - *At the end of this phase the teacher discusses the different answers the students gave in a classroom discourse.*

Suggested tools/materials: tablet
Estimated duration: 20 minutes