INNOMATH: Innovative enriching education processes for Mathematically Gifted Students in Europe

Reference number: 2019-1-DE03-KA201- 059604

Implementation period: September 2019 – August 2021

Training program for teachers or others interested in the identification/ support/ enriching with practical skills of mathematically gifted students in the context of the INNOMATH project

Module Number and Area/ Topic: 4. Problem Solving Methods

Introduction and Broad Description of the Context and Goal of the area/ topic addressed: In this module we will deal with problem solving. We will try out and experience different problem-solving strategies using examples and shed light on the theoretical background of problem solving.

Learning Outcomes: With the completion of this module the trainees will be able to ……

1. Understand the importance of problem solving in mathematics education
2. Have a collection of problems of different difficulty levels and different topics to practice problem solving with students
3. Know various problem solving strategies and can apply them purposefully and provide specific guidance to students about them

Content and Resources (providing information on the various constituents/ dimensions of the topic under consideration): Examples are presented from most grade levels and many school-relevant thematic areas. These will be made available in a beamer presentation. A beamer

presentation with solutions and supplemental information is also available for the instructor.

Methodology and approaches for the module training presentation: The participants can experience problem solving themselves with many examples and thus experience the positive effects of successful problem solving. In addition, the strategies used in the process are reflected upon and thus made accessible for other problems and, in particular, the repertoire of problem-solving strategies is expanded. This encourages and further empowers teachers to integrate and train problem solving even more intensively in the classroom.

Instruments/ Tools/ Supporting Material/ Resources to be used: …………
- Module4-innomath-problem-solving-beamer.pdf (presentation)
- Module4-innomath-problem-solving-handout.pdf
- Module4-innomath-problem-solving.pdf (only for lecturer)
- Module4-Worksheet-Examples-5-10.pdf
- Module4-Handout-Polya-Questions.pdf
- Module4-Worksheet-Making-Task-Accessible.pdf
- Module4-Making-Task-Accessible.ggb (GeoGebra-file)

Pedagogical/Learning Sequencing and Activities Plan:

Introductory activities

Activity Number and broad Description: Problem Solving: General Positions, Definition	
Development	Introduction and entry
Materials	Lecture slides 1 to 8
Resources	Module4-innomath-problem-solving-beamer.pdf
Estimated Time	10 min
Environment/Room Setting	Lecture, all participants together
Trainees' role	Listening, taking notes

Development activities

Activity Number and broad Description: Problem Solving in elementary school: Examples	
Development	Getting first ideas of low level problem solving
Materials	Lecutre slides 9 to 16
Resources	Module4-innomath-problem-solving-beamer.pdf
Estimated Time	10 min
Environment/Room Setting	Discussion, all participants together
Trainees' role	Discussion

Practicing Activities (hands-on activity)

Activity Number and broad Description: Examples	
Development	Solving Problems – Examples
Materials	Module4-Worksheet-Examples-5-10.pdf and Lecture slides 17 to 35
Resources	Module4-innomath-problem-solving-beamer.pdf, Module4-Worksheet-Examples-5-10.pdf
Estimated Time	100 min
Environment/Room Setting	Switch between small groups and discussions with all participants
Trainees' role	Work in small groups and contribute to discussion with all participants

Development activities

Activity Number and broad Description: Problem Solving – Polya-Questions and Cognitive Structures	
Development	Getting to know a helpful tool for teachers
Materials	Lecture slides 36 to 41, Module4-Handout-Polya-Questions.pdf
Resources	Module4-innomath-problem-solving-beamer.pdf, Module4-Handout-Polya-Questions.pdf
Estimated Time	5 min
Environment/Room Setting	Lecture, all participants together
Trainees' role	Paying attention

Reflective activities

Activity Number and broad Description: Problem Solving – Reflection on Heuristic Strategies	
Development	Reflecting on heuristic strategies used
Materials	Lecture slides 42 to 47
Resources	Module4-innomath-problem-solving-beamer.pdf
Estimated Time	15 min
Environment/Room Setting	Discussion, all participants together
Trainees' role	Discussion

Development activities

Activity Number and broad Description: Problem Solving – General Heuristic Structures	
Development	Informations on some more general heuristic structures
Materials	Lecture slides 48 to 71
Resources	Module4-innomath-problem-solving-beamer.pdf
Estimated Time	15 min
Environment/Room Setting	Lecture, all participants together
Trainees' role	Paying attention

Evaluation of Learning Outcomes

Activity Number and broad Description:	
Development	Making tasks accessible and promoting creativity
Materials	Lecture slides 72 to 82, Module4-Worksheet-Making-Tasks-Accessible.pdf, GeoGebra: Module4-Making-Task-Accessible.ggb

Resources	Module4-innomath-problem-solving-beamer.pdf, Module4-Worksheet-Making-Tasks-Accessible.pdf, Module4-Making-Task-Accessible.ggb
Estimate Time	25 min
Environment/Room Setting	Lecture and working in small groups
Trainees' role	Paying attention during short lecture part, working in small groups

Reflection and Closure activity:

Finally, the participants will work in small groups to develop suggestions on how to make a specific problem accessible to students. For this the participants will need at least one computer with GeoGebra for each group. This will then be discussed in plenary.