# ANALYSIS OF MATHEMATICALLY GIFTED STUDENTS' ANSWERS TO COGNITIVELY DEMANDING SCHOOL TASKS

Clara Benedicto, Angel Gutierrez, and Adela Jaime

Universidad de Valencia, Valencia, Spain

Research shows that challenging tasks make mathematically gifted students (gifted students hereafter) struggle and engage in high order thinking (NCTM, 2014). There is a need to develop tools to help teachers and researchers design and evaluate the adequacy of tasks to that objective. The *model of cognitive demand* is one of such tools, that is producing interesting results. We present a part of a research project[1] aimed to analyse the cognitive demand levels achieved by gifted students when solving *rich tasks* based on ordinary school contents.

A *rich task* is formed by a series of questions where the first ones are within reach of all students, and the successive questions require deeper use of mathematical contents and more complex reasoning. The *model of cognitive demand* evaluates the complexity of students' reasoning while solving tasks. It characterizes four levels of increasing cognitive demand (Benedicto et al., 2017): 1) *memorization*, 2) *procedures without connections*, 3) *procedures with connections*, and 4) *doing mathematics*.

We present results from an experiment based on rich tasks about polygons. We analyse the cognitive demand levels of the answers by 7 gifted students (aged 11-13), 15 ordinary students in primary grade 5 (aged 10-11) and 50 in secondary grade 7 (aged 12-13) to one task. We analyse the 75% of students who answered the task.

The task had three parts. Part 1: draw and count the diagonals from a vertex in 3- to 5-sided polygons. All the students answered it in the 2nd level. Part 2: count the diagonals from a vertex in 3- to 7-sided polygons and state a general rule for any polygon. Some students answered it in the 2nd level and others combined 2nd and 3rd levels. Part 3: count all the diagonals in 3- to 7-sided and 20-sided polygons, and state a general rule for any polygon. 13% of 5th graders, 56% of 7th graders and 86% of gifted students solved the last question showing the 4th level of cognitive demand.

We conclude that i) rich tasks are useful to identify gifted students in ordinary classrooms, and ii) the cognitive demand levels allow differentiate trajectories of problem solving between gifted and ordinary students, and between different gifted students.

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## References

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