

Appendix 1. Description of mathematical modeling tasks and the number of student responses collected

Group	Description of modeling tasks	Pilot testing
G1	The expenses of a bus company is mathematically modeled with the quadratic function of a timetable.	21 middle-school students
G2	Based on the congestion coefficient, the evacuation time of high school students in an emergency situation is mathematically modeled with quadratic functions regarding the use emergency stairs or evacuation slides.	20 high-school students
G3	Based on the Richardson's model of the amount of change in national armaments, the arms race situation of each country is mathematically modeled as sequences.	13 high-school students
G4	The amount of sunscreen used depending on the facial area is mathematically modeled with integral equations.	26 high-school students
G5	The vehicle speed at which fuel efficiency is maximized is mathematically modeled with quadratic functions and derivatives.	26 high-school students
G6	The chance of a student receiving a cultural gift certificate depending on assessment criteria is mathematically modeled as a probability model.	19 high-school students
G7	Efficient space utilization of the low-floor bus door is mathematically modeled with integral equations of envelope of a family of curves.	22 high-school students
G8	Based on the damage to the ground and liquefaction index, the effect of an earthquake is mathematically modeled as integral.	31 high-school students
G9	Based on the concept of solubility and threshold value for the tangy taste of a carbonated beverage, mathematical modeling is carried out with linear models.	30 middle-school students
G10	The velocity of a kicked ball against the goalkeeper is mathematically modeled with integral equations.	18 high-school students
G11	Based on the concept that the thickness of snow accumulated per hour is proportional to the change in the thickness of the cloud, the vehicle mobility is mathematically modeled with integral equations.	19 high-school students