Appendix I

Table 1. Instrument for assessing pre- and post-test inquiry task. Each assessment level description is illustrated with an example obtained from the students' test inquiry tasks.

0. Does not identify the problem or ask questions that cannot be addressed. *Why flowers do not have the same physical appearance?* **1. Confuses the question with hypotheses.** *Sun and water are related to flower growth.* **2. Identifies the problem in a generic way or with conceptual problems.** *How long does the growth of flowers last?* **3. Identifies a researchable question but cannot be addressed in elementary education**. *The more they decompose, will they have less pollination?* **4. Identifies a researchable question that leads to an experimental design in elementary education.** *If there is more heat, will more flowers bloom?*	**1. IDENTIFICATION OF RESEARCH QUESTIONS**
0. Does not propose or identify predictions or hypothesis, or poses them without meaning. *If we don't take care of plants, they will die.* **1. Formulates predictions and hypothesis without relation to the question or objectives**. *I think the sun is related to flowers growth; maybe the pink rose should not be in the sun.* **2. Poses ambiguous hypothesis and predictions, but related to the research topic.** *Some flowers have dried because they have not been watered.* **3. Poses at least one of the three requested hypothesis or prediction that fits with the research question and includes possible study variables.** *There is a rose which is more pigmented maybe because it has flourished recently.* **4. Poses more than one hypothesis or prediction that fit with the research problems and that include possible study variables.**	**2. FORMULATION OF INITIAL IDEAS: PREDICTIONS AND HYPOTHESIS**
0. Study variables are not contemplated. **1. Identifies study variables that do not fit with considered previous ideas or researchable question.** I *put the plants in different places and I write down the measurement (in reference to the hypothesis "If the seed has no sunlight, it will not germinate").* **2. Identifies ambiguous independent or dependent variables that relate to the research question and the considered previous ideas**. *I change the quantity of sunlight and I verify that the hypothesis is true.* **3. Identifies both independent and dependent variables related to the research question and the considered previous ideas**. *I change the place of the plant, with and without light. I measure the growth, quantity of flowers and color.* **4. Identifies and defines both independent and dependent variables that fit with the researchable question and the considered previous ideas**. *We verify that all the plants have the same amount of water. We put some plants with sunlight and some of them without it. The amount of light is the variable that I change. Then, we take photographs and growth measures every two days to see its growth.*	**3. IDENTIFICATION OF VARIABLES**
0. No experimental design is proposed. *We must water the plant with 15 ml each day and talk to it and, then, see if it has grown more.* **1. The experimental design has no relation to the researchable question and does not allow the verification of the hypotheses or predictions.** *First we add fertilizer and the seed inside a pot. We put the pot in a place where the sun arrives and, as the day progresses, we collect data.* **2. The experimental design is related to the considered hypotheses, but its description (use of materials, instruments, steps to follow) is incomplete and does not state the control variables**. *It would place plants of the same species in different places, some with more light and others with less light. Then I would write down the data.*	**4. PLANNING AN INVESTIGATION**

3. The experimental design allows the verification of the hypothesis and predictions, with an adequate description, but with incomplete control variables. *We will plant the seed independently, so as the sunlight arrives to only one seed. Every two days we will measure the plants and compare the color and quantity of flowers to see if the light is important.*	
4. The experimental design allows the verification of the hypothesis and predictions in a reliable way, presenting appropriate control variables. *I let the seeds grow alone with sunlight, without water. In another place, I put the seeds and I give them the same amount of water each day. Also, I measure if they have the same temperature each day with the thermometer. During a week, I'll measure the seeds growth with a rule only with sunlight or if they also need water.*	
0. No data representation.	**5. REPRESENTATION OF DATA**
1. Inadequate graphic representation: e.g. inadequate type of graphic; the scale on the axis does not run vertically (Y) or horizontally (X) through zero.	
2. Poor data treatment and incomplete graphic representation: marks in the X or Y axis are not equally spaced; no identification of the type of variable represented in each axis.	
3. Adequate data representation (correct axis scales) but only represent a portion of data or use different graphs for representing sets of data that could be compared if represented simultaneously in one graph.	
4. Adequate data representation and use of one graph for representing and comparing different sets of data	
0. Without data analysis. *Plants need sunlight to grow.*	**6. ANALYSYS OF DATA AND BUILDING SCIENTIFIC EXPLANATIONS**
1. Poor analysis and explanations not based on data. *It is better to place a single plant in a pot because it grows faster.*	
2. Explanations are just descriptions of the results. *If there is a single plant in a pot the growth is better, but if there are more plants, the growth of each plant decreases.*	
3. Incomplete analysis but with an incipient coordination between theoretical justifications and empirical tests, including a check of the initial hypothesis or predictions and scientific vocabulary. *The plant that is alone in a pot grows faster because all the water and the mineral salts are for her; but when there are more plants in a pot they have to share it.*	
4. Well-founded data analysis, with explanations based on evidence. Coordinates theoretical justifications with empirical evidence. *The first day all the plants have the same height. But as the days go by, plants which share the same pot do not grow as much as the plant that it is alone in one pot (…) the more plants in the same pot, the more water, space and mineral salts must be distributed (…) then, each plant has less nutrients and, thus, less growth. If a plant dies, its decomposition will help to the growth of the other plants"*	