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**Students, teachers, experts reflect on errors and difficulties
in the mathematics teaching/learning process**

Self-evaluation in primary school

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Abstract

This contribution concerns a self-evaluation experience in a network of schools in Italy (Torino), Hungary (Budapest), Spain (Granada), Greece (Athens), involved in the VALMAT (Evaluation in Mathematics) project.

The project aims at promoting the interaction of teachers, students and experts in order to stimulate the discussion on the analysis of learning obstacles and on how to foster improvement and motivation “to do maths in school and outside of the classroom”.

The theoretical framework follows a psycho-pedagogic, constructive and meta-cognitive approach which considers error an opportunity for learning.

The teachers fill in a questionnaire before the children take the diagnostic tests. They write their expectations of how the students will perform, what kind of difficulties they will encounter.

At the end of the test the students receive five small coloured stickers. They are asked to put them by the five test items they feel most confident they have done correctly (jolly faces technique).

The analysis of the answers given by teachers and students is rich in data, reflection, observations and discussions.

There may be a positive correspondence or a negative correspondence between what the students think and what they are actually able to do. The student's evaluation, that depends on the perception they have of their own learning, is also related to the evaluation given by the teachers regarding the abilities of their pupils.

The most interesting cases are those where there is no correspondence between what the students think and what they actually know, for instance, writing a half in the form of a decimal number, where the meta-cognition influence is stronger.

The questions of the tests used in the VALMAT project aim at assessing both mathematical knowledge and cognitive strategies.

Analyzing and evaluating the student's answers to the questions requiring argumentation has been very productive for the teachers.

Extended Summary

Background

This contribution concerns a self-evaluation experience in an Italian network of schools in Torino (AVIMES “Autovalutazione di Istituto per il Miglioramento dell’Efficacia della Scuola”), linked with some primary schools in the following countries: Hungary (Budapest), Spain (Granada), Greece (Athens), involved in the VALMAT (Evaluation in Mathematics) project.

The project stems from the concern of the work groups of the above four cities with regard to the different levels of student's mathematics achievements in international tests (TIMSS and PISA). The project aims at promoting the interaction of teachers, students and experts in order to stimulate the discussion on the analysis of learning obstacles and on how to foster improvement and motivation "to do maths in school and outside of the classroom".

The theoretical framework follows a psycho-pedagogic, constructive and meta-cognitive approach which considers error an opportunity for learning.

Method

The teachers fill in a questionnaire before the children take the diagnostic tests. They write their expectations of how the students will perform, what kind of difficulties they will encounter, to what extent the questions of the test overlap the curriculum carried out in the classroom.

The tests taken by the children present closed-ended questions (multiple choice) and open-ended extended questions that require argumentation.

At the end of the test the students receive five small coloured stickers. They are asked to put them by the five test items they feel most confident they have done correctly (jolly faces technique).

The analysis of the answers given by teachers and students is rich in data, reflection, observations and discussions.

International comparisons lead to further reflection, for instance the translation of test instructions into the four languages and the relationship between formal mathematics vocabulary and everyday language.

Consider, for example, the symbol $\frac{1}{2}$ that can be expressed in Italian in three different ways, while in Hungarian there is only one possible lexical expression – *fel* – which is the same in everyday language and in formal mathematics language.

The analysis of the comparisons between the correctness of the answers given by individual students and the attribution of the stickers to the five test items they think they are certain they have done correctly, is very interesting.

There are four possibilities:

- 1) I think I know and I do know
- 2) I think I don't know and I actually don't know
- 3) I think I know and I actually don't know
- 4) I think I don't know and I do know

There may be a positive correspondence or a negative correspondence between what the students think and what they are actually able to do. The student's evaluation, that depends on the perception they have of their own learning, is also related to the evaluation given by the teachers regarding the abilities of their pupils.

Results

The level of meta-evaluation correspondence is high only with regard to computation items (adding).

Problem solving items have seldom been chosen by the students.

The most interesting cases are those where there is no correspondence between what the students think and what they actually know, for instance, writing *a half* in the form of a decimal number, where the meta-cognition influence is stronger.

The questions of the tests used in the VALMAT project aim at assessing both mathematical knowledge and cognitive strategies.

Analyzing and evaluating the student's answers to the questions requiring argumentation has been very productive for the teachers. See the example of "The bus problem" (referring to students of 10-11).

Read the text of the problem

In a school there are 415 children and 35 teachers taking part in a school trip at the end of the school year.

Buses with 60 seats each can be hired.

How many buses do you need to hire?

Cross the right solution.

$$415 : 60 = 6 \text{ remainder } 55$$

6 buses

$$415 + 35 = 450 \quad 450 : 60 = 7 \text{ remainder } 30$$

7 buses

$$415 + 35 = 450 \quad 450 : 60 = 7 \text{ remainder } 30$$

8 buses

And now explain how you decided which is the correct solution.

Percentage of respondents:

6 buses → 8,1%

7 buses → 46,7%

8 buses → 43,7%

Blank → 1,5%

The teachers involved in the research have examined the papers of 261 students and have discussed at large on how to classify the various and often surprising answers given by the pupils.

Right answer 8 buses

“In the second solution there is remainder 30 and you can’t sit on the floor”.

“You need 8 buses because 30 persons cannot certainly go on foot”.

“I have noticed that 7 buses have remainder 30, so where can we put those 30 children? We need another bus”.

“It’s better to have 30 seats more than 30 or 90 less!”

Wrong answer 7 buses

“For me 7 is fine. There is always someone missing”.

“It is the fastest and simplest answer”.

“I think you can also book a bus less, there would be enough place anyway”.

Follow-up

The phase of reporting back the results to the teachers of the schools participating in the project has proved especially effective. Reporting back the results in a didactic way and not merely with statistical data has proved very useful in fostering the interest of the teachers in reflecting on their own teaching methods and improving them.

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