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Fostering self-regulated learning in an assessment situation

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Abstract

Introduction. This article deals with classroom assessment situations from a socio-cultural perspective. Some characteristics of classroom assessment are identified and described as they relate to the teachers' pedagogical intervention for the monitoring and improvement of students' self-regulation processes.

Method. A qualitative methodological approach was chosen for the analysis of one video-recorded assessment situation. One 6th grade mathematics class (12 year-olds) was observed along several periods during which assessment took place. The analysis was performed with an instrument that allowed us to identify global characteristics of the assessment situation, as well as its different components or sections.

Results. Results reveal some specific ways that the teacher helps his students in sessions prior to and immediately after the assessment session. These interventions are oriented toward preparation and then to correcting and returning results, maximing the pedagogical benefit.

Conclusion. Our conclusion is that self-regulation is a complex ability to be taught and learned. Thus, it cannot be left to chance. On the contrary, it requires specific didactic design in order to promote and guide the transition from external regulation to independent self-regulation of the learning process.

Key Words: self-regulation, teacher support, classroom assessment, pedagogical dimension of assessment, joint activity.

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Introduction

Learning to regulate one's learning, that is, becoming increasingly autonomous in the processes of planning, control and assessment of learning, is one of the great challenges of education in our day, and at the same time a priority for research in Educational Psychology.

Self-regulated learning has been thoroughly analyzed, and several theories and explanatory models have been proposed in order to identify inherent processes and their relationship to academic performance of students[1]. Several aspects involved in the process of students' self-regulated learning have emerged from the different perspectives and traditions (Boekaerts, 1999; Pintrich, 2000; Corno, 2001; Zimmerman, 2002; Schunk & Zimmerman, 2003). First, the student's active, leading role in planning, control and management of mental processes toward the achievement of specific goals. Second, the underlying complexity of self-regulated learning, as it involves quite diverse processes and factors. One of the models that attempts to account for this complexity is the Pintrich model (2000), where four phases are identified, these include different regulatory processes: planning, self-monitoring, control and evaluation. Each of these phases in turn incorporates self-regulation processes linked to several specific areas or dimensions: cognitive, motivational and affective, behavioral and contextual.

In addition to these aspects –the student's leading role in self-regulation, and the complexity of the latter—we must include the role played by the teacher in guiding and orienting students' regulatory processes (Mauri & Rochera, 1997; Monereo & Castelló, 1997; Shunck & Zimmerman, 1998, 2003; Torrano & González, 2004; Souvignier & Mokhlesgerami, 2006). From a sociocultural, constructivist perspective of school teaching and learning, foundational to this study, this help and support from the teacher in regulating learning processes is a key factor for understanding students' development of competencies of autonomous regulation of learning processes (Coll, 1990; 2001). In this sense, some studies have shown that it is difficult for students to become autonomous in learning and make use of self-regulation abilities if they are not offered suitable conditions for exercising such autonomy (Gipps, 1999; Norton, 2004; Coll et al, 2006).

[1] This same journal has published an ample review of self-regulated learning. See Torrano, F. I, González, M.C. (2004). Self-regulated learning: Current and future directions. *Electronic Journal of Research in Educational Psychology 2, (1),* 1-34.

In this context, assessment becomes a fundamental instrument for regulating teacher intervention over the course of the process, and in turn becomes a useful element for students to be able to self-regulate their own learning process (Allal, 1991; Black & Wiliam, 1998; 2003; Barberà, 1999; Wiliam, 2000; Broadfoot & Black, 2004; Macdonald, 2006). Assessment situations can be considered advantageous viewpoints from which to observe the meanings which students construct, these being more visible and transparent. Thus it may be interesting to study how the teacher carries out support and guidance in these situations, when the primary intent is to teach students how to self-regulate, and not only fulfill assessment requirements. In these situations there is often a joint pedagogical function of assessment coexisting with the social function of assessing and accrediting results of students' learning.

The importance assigned to the pedagogic, regulatory function of assessment is a common factor in a series of studies that have helped spread the use of the terms "formative assessment" and "developmental assessment" (Nunziati, 1990; Allal, 1991). These concepts are used in describing the potential of assessment practices for regulating teaching and for adjusting processes which the students carry out, and as an instrument for students to learn to regulate their own learning. These types of formative and developmental assessment can coexist with the accrediting, social purpose of assessment, as long as their use as an instrument for regulating the teaching and learning process is not subordinated to the social purpose (Coll & Onrubia, 1999; Solé, Miras & Castells, 2003).

Elements which make up assessment according to a pedagogical perspective are "need" and "action" (Wiliam, 2000). From the teacher's point of view, there is a "need" to collect information about the student's learning process, and the "action" takes shape in (1) feeding back to students their results, so that they may reflect on their learning, (2) making decisions about educational actions which can improve the students' tutorial processes. From the students' perspective, the "need" consists of knowing the criteria by which their learning will be assessed, while the "action" takes shape in learning to self-regulate.

Educational actions which make it possible to adjust educational help to students' regulation process can take place at three levels (Allal, 1991). At the first level, the teacher can adjust his or her help within the interaction that is produced in the joint activity constructed by teacher and students around some classroom content (interactive regulation). At the second level, the teacher may decide to adjust some elements of the teaching and

learning process once the classroom session is over and after performing an assessment thereof. This regulation, with a more proactive nature, can involve revising one's planning, or including some further activity. At the third level, the teacher may decide to go over some of the content that had been worked on in the course of the teaching and learning process, once the assessment activity is completed. This regulation, with a more retroactive nature, involves designing remedial activities after the assessment.

The approach to assessment practices which we carry out in this article is not limited to the study of the assessment instrument or the tasks that it comprises. In line with the sociocultural perspective which guides this study, it is necessary to consider activities carried out both before and after the assessment itself –the assessment situation understood in a global sense—if we want to understand how students can be helped in self-regulated learning through assessment (Coll, Barberà & Onrubia, 2000; Coll, Martín & Onrubia, 2001; Colomina & Rochera, 2002).

Our objective is to identify and describe some characteristics of the assessment situations of students' learning and of the teacher's action in these types of situations which may offer support and guidance to developing regulated learning abilities in the students.

Method

Participants and design

Participants are the teacher and 17 students which make up a 6th grade class in primary education. The school's history of innovation in assessment was taken into account in selecting this situation; this had involved the design and implementation of new instruments for assessing learning at this educational level.

A qualitative analysis methodology was used to analyze a situation for assessing multiples and factors content (Candela et al. 2004; Flick, 2004). The situation took place in a 6th grade primary classroom (12 year-olds) in the area of Mathematics, within a preschool/primary school in Barcelona (Spain).

Procedure

This situation, which followed a didactic sequence on the above content, was recorded via audio and video, and preceded and followed by interviews with the teacher and the students in the class. Other data sources were also used, such as the materials used in performing the assessment and the work produced by students in the process. The fundamental body of data is made up of records from the six sessions which comprise the assessment situation as a whole, organized around the preparation, execution and review of a written test. In between some of the recorded sessions, activities linked to the assessment took place outside the classroom and therefore were not recorded, although their effects were considered in the analysis and interpretation of the data.

The assessment situation under observation took place at the end of a didactic sequence on the topic of multiples and factors. One week before the written assessment, the teacher dedicated one session to reviewing the content on multiples and factors with the students (*notions of the multiple, powers, breaking down a number into prime factors, greatest common factor, lowest common multiple, etc.*). The assessment was carried out using a 60-minute written test (within an 80-minute class session) (see appendix 1). Afterward, the teacher corrected the test outside the classroom, assessing the answers qualitatively and quantitatively. These assessments were communicated to the students in two sessions lasting 26 and 46 minutes. Next, two additional class sessions were dedicated to performing activities for clarification of doubts, correcting mistakes and reflecting on the assessment results (46 and 22 minutes, respectively). Between the two sessions the students had to carry out some activity outside the classroom as a consequence of results obtained on the written test. In order to do these later activities, both the teacher and the students used material where they had to assess the results obtained and where the students had to redo exercises from the test on multiples and factors where they had answered incorrectly (see appendix 2).

Data analysis

Analysis was performed by applying an instrument which was developed within the framework of a research project on assessment practices, of which this study forms a part[3]. This project is based on studies regarding interactivity, knowledge construction in the classroom and mechanisms of educational influence, carried out by Coll and collaborators (see, for example, Coll, Colomina, Onrubia & Rochera, 1995; Coll, Barberà & Onrubia, 2000). From these studies it was possible to identify certain *mechanisms of educational influence* which operate in *segments of interactivity,* that is, in specific fragments or ways of organizing joint activity between teachers and students in an educational situation. Proceeding from the same theoretical positioning, but keeping in mind the specific characteristics of assessment, the instrument allows for distinguishing different parts or fragments in an assessment situation taken as a whole: activities or *segments of assessment* in a strict sense, activities or *segments of preparation* (prior to assessment in a strict sense) and activities or *segments of correction/scoring, segments of communication/feedback* and *segments for use* (following assessment in a strict sense).

This instrument makes it possible to differentiate, within a global assessment situation, fragments of joint activity where dominant patterns of action can be identified in the participants, being guided by different motives. Thus, the motive of preparing students for executing assessment tasks (*preparation segments*); the motive of executing assessment tasks (*assessment segments*); the motive of correcting or scoring students' participation in assessment taks and/or the results or products that they have generated (*correction/scoring segment*); the motive of communicating to students the correction and scoring of their participation in assessment tasks and/or the results or products that they have generated (*communication/feedback segments*); and the motive of pedagogical application, through specific activites, of the correction or scoring of students' participation in assessment tasks and/or the results or products that they have generated (*use segments).*

The instrument for analyzing assessment situations further proposes different dimensions and subdimensions, for each type of segment, recognizing different aspects of the assessment situation, as shown in Table 1.

Table 1. Analysis dimensions of the Assessment Situation

[3] Coll, C.; Barberà, E.; Colomina, R.; Onrubia, J. & Rochera, M.J. (authors), with the participation of Lago, J.M.; Naranjo, M. & Remesal, A. (1999). Pauta de análisis de las situaciones de evaluación en matemáticas. [Guidelines for analyzing assessment situations in mathematics.] (Document for internal use).

Dimensions of analysis	Subdimensions of analysis
Preparation segments: activities perfomed in the classroom explicitly aimed at preparing students' participation in the assessment situation. Through these activities, teachers and students can share meanings regarding the conceptual, procedural and attitudinal content which will be the focus of the assessment situation per se.	*Ways of organizing the joint activity: dominant action patterns of participants.*
	Content of the assessment tasks
	Working on execution procedures
	Criteria for correction: making them explicit or not
Assessment segments per se: activities that students must resolve in order to demonstrate the degree and level to which they have met the objectives set by the teacher for that assessment situation.	*Ways of organizing the joint activity*
	Instruments and materials used
	Type and nature of the content
	Cognitive demand
	Number of and relationships between the tasks
Correction segments: activities addressed to making a value judgment on students' participation in that situation and/or on the results or products that they have generated or which are requested from them.	*Ways of organizing the joint activity*
	Correction criteria
	Focus of the correction
	Context of correction and its agent
Feedback segments: activities where students receive the correction of their participation in the assessment situation and/or the results or products that they have generated, that is, activities which involve showing or sharing with students the assessment of their results.	*Ways of organizing the joint activity*
	Focus of the feedback
	Context of the feedback and its agent
	Modality of feedback: public or private
	Instruments and materials used
Use segments: activities carried out by applying an aspect or aspects that the assessment situation intended to cover.	*Ways of organizing the joint activity*
	Focus of the use
	Instruments and materials used

In the *preparation segments,* some aspects analyzed are the "ways of organizing the joint activity" (fragments of joint activity for which it is possible to identify participants' dominant action patterns with the primary intent of preparing students for assessment tasks), the "content of assessment tasks" and "working on execution procedures" (the focus of the assessment), and whether or not the "correction criteria" to be used for the test are made explicit. In the *correction segment*, similarly, we consider the "ways of organizing the joint activity", (in this case oriented toward correcting the assessment tasks), the "correction criteria*"* that are being used and whether or not they are explicit, and the "focus of the segment"; in addition, the "correction context and agent" are also taken into account (whether it takes place inside or outside the classroom and if it is performed by the teacher, the students, or both). In the *feedback* and *use* segments, similar analysis dimensions are used. It is worth mentioning that, in the case of *feedback segments* the feedback "modality" is also considered (whether it is public or private), and the "instruments and materials" used. This last dimension is also analyzed in the *use segments*. Finally, in the actual *assessment segments per se,* in addition to the "ways of organizing the joint activity*"* (in this case oriented toward executing the assessment tasks themselves), the "instruments and materials used", we also

give consideration to several dimensions referring to analysis of tasks and content which are the object of the assessment itself ("the type and nature of the content" which is being evaluated, the "cognitive demand", the "number" of and possible "relationships and interconnections" between the tasks proposed).

Results

The results which follow refer first to the general assessment situation, with consideration given to the types of segments which comprise it. Second, they refer to certain particularities of the different segment types which provide evidence of different, concrete ways that self-regulated learning is taught to the students in this mathematics assessment situation.

The first set of data describes the *general configuration of the situation* and is displayed graphically on a map of assessment segments (see Figure 1). As shown on this map, the assessment situation has a total of 10 assessment segments of different types, both preceding and following the assessment segment per se. Thus, the first of the two segments before the test is designed to prepare for the test through review and clarification of doubts regarding multiples and factors, while the second, of shorter duration, takes place during the same session as the test performance, and focuses on a set of rules and clarifications in order to complete the test. After taking the test, we find 7 assessment segments of different types. The first is a correction segment (which remains unobserved since it takes place outside the classroom), followed by a segment of feedback of results, where the class group is presented with some of the results from the test, the correction criteria used, and where certain questions where students have made mistakes are corrected. A new correction segment appears (also unobserved) followed by a new feedback segment, in this case, returning individual results privately to each of the students in the sample. Next there are three use segments. The first requires students to reflect on and put in writing strategies they followed in order to study this topic and to set new objectives for the future based on the results obtained. In the second segment (unobserved since students performed it outside the classroom), students redid the exercises which were not solved correctly, over a week's time. Finally, in the third segment we find teacher actions aimed at carrying out a set of different reflection processes which

relate to the content being assessed and the strategies and attitudes which students have used in learning.

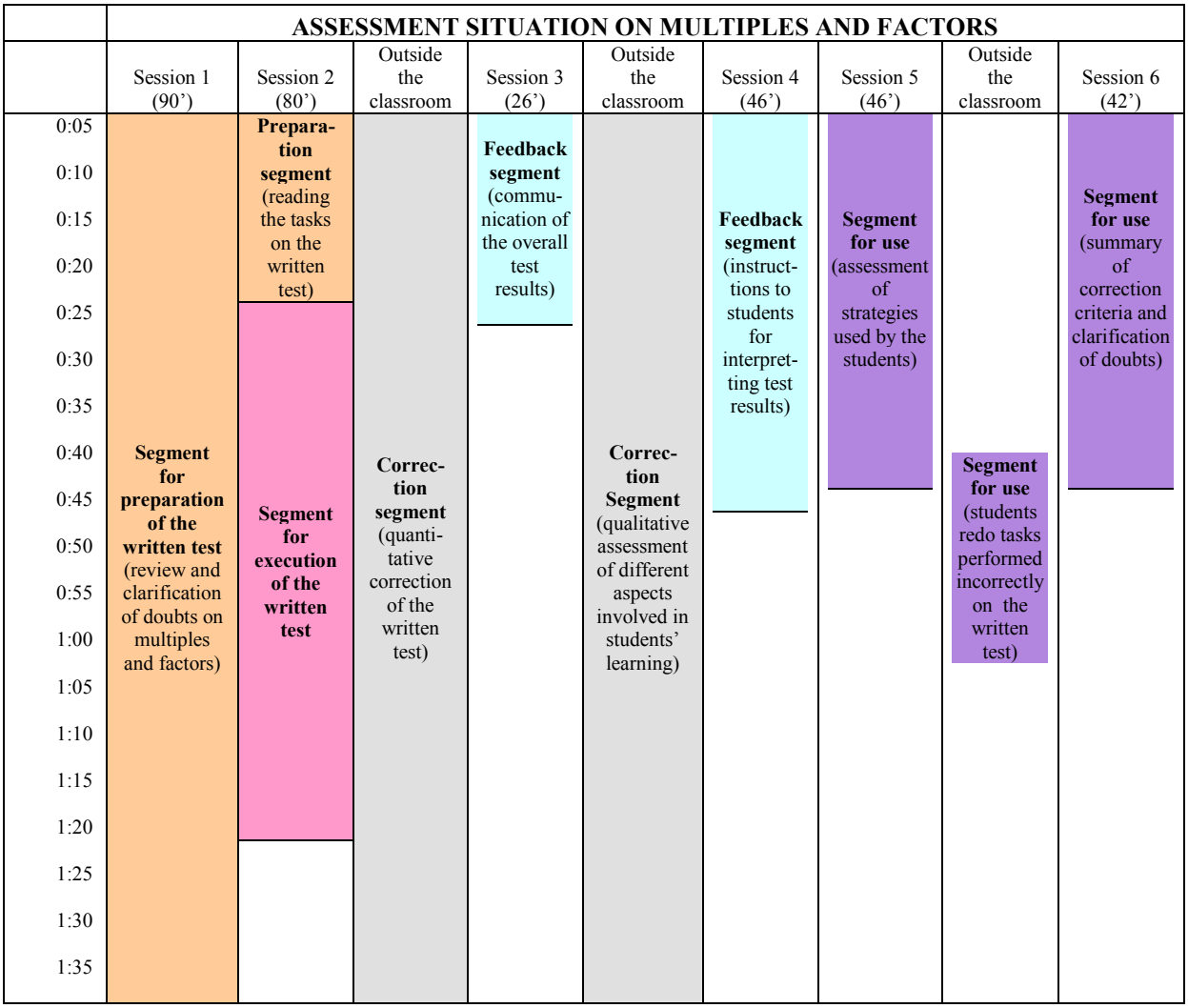

Figure 1. General configuration of the assessment situation

A second set of results refers to segments which precede (*preparation segments*) or follow (*correction, feedback and use*) the assessment per se.

In the *preparation segments,* thanks to application of analysis guidelines, relevant data were found with regard to the self-regulation helps that the teacher provided. Thus, during the first preparation segment (90') the teacher asks students different content questions on multiples and factors—content previously worked on in class—while at the same time writing on the board a list with the whole set of content. Meanwhile she clarifies doubts that come up and offers guidelines about resources and strategies that students can use while studying. Data

show that they are simultaneously working on the mathematical content (concepts of multiples, powers, square root, breaking down into prime factors, etc.), as well as strategies and attitudes that help the student to study and regulate learning this content (study strategies, study planning, resources and places to get help, self-regulation and responsibility in preparing for the test, etc.). In the second preparation segment (moments before the test), the teacher reads aloud the tasks on the test, provides some guidance for solving certain mathematical problems and indicates rules that students must follow in order to do the test correctly.

Analysis dimensions relating to the set of segments following the test bring to light different elements addressed to students to help them self-regulate learning. The *correction segments* take place at two times. On the first occasion, the teacher corrects the students' tests outside of class using quantitative criteria. On the second occaion, also outside the classroom, the teacher qualitatively evaluates the effort students have made, study strategies used, how well they have paid attention in class, etc. Both qualitative and quantitative criteria are communicated to students before giving them their test results. After the first correction segment *a feedback segment* takes place, where the global results from the written test are communicated to the class orally. In the second *feedback segment* the teacher gives more precise explanations to the students so that they can interpret their results, referring first to notations made by the teacher on each test, then to scoring for each question and for the entire test. Following this the teacher returns the tests to each student for them to look over.

Next, three *use segments* take place. In the first, the teacher hands out a sheet where students are to assess the study strategies used in preparing for the mathematics test, strategies for solving tasks on the test, and objectives for the future for improved learning results. In order to carry out this assessment, students have a guide sheet where the teacher has offered several indications (observations on the effort that was made, assessment of problem-solving procedures and results obtained, guidelines for fixing errors, etc.). During the second segment the students correct the tasks which they had performed incorrectly at home, over a week's time. If they are unable to solve the tasks, they can get help from the teacher, as long as this help is requested in writing. Finally, in the third use segment the teacher summarizes the quantitative and qualitative criteria used for correcting the test, and clarifies any remaining doubts through a series of questions and answers. Following this the teacher has the students reflect on the educational value of the two prior use segments as special opportunities for

reviewing all that has been learned, and proceeding to list them: mathematical concepts and procedures for solving exercises, study strategies, metacognitive skills for planning and reviewing results, attitudes for studying and for solving tasks on the mathematics test, etc.

Conclusions

Results presented here lead to certain conclusions which respond to the objective of this article, that is, identification of some characteristics of an assessment situation and of the teaching action in this type of situation that can optimize self-regulated learning in students.

The first nucleus of conclusions points to the usefulness and the theoretical and practical interest of widening the focus when analyzing assessment practices, moving beyond the assessment tasks per se to the global assessment situation, differentiating the parts or segments involved. The situation analyzed in this article underscores that teaching regulated learning can be greatly enhanced when time is spent before and after assessment tasks, devoting this time to preparation and then to correction, feedback and pedagogical use of results.

These situations seem to fulfill certain basic conditions for teaching students to regulate their own learning: (i) they generate an appropriate global context –the complete assessment situation—for the student to be able to learn strategies for understanding content, to appropriate objectives involved in the activities and tasks, to plan their study, to decide on the most suitable strategies for resolving assessment activities and tasks, to review the planned course of action, what was actually realized and the results obtained; (ii) they provide several frameworks for joint activity between teachers and students where there can be contextualized learning of the most suitable strategies in each case for addressing the preparation, execution and supervision of assessment activities and tasks; and (iii) they make available to the student a variety of guides for developing self-regulation competencies.

A second group of conclusions refers to situations which precede and follow the assessment situation per se, and especially to the type of support and aid which the teacher offers to facilitate the students' contextualized learning of planning, control and the reorientation of learning. Results lead us to confirm that learning to regulate learning is not a simple task, on the contrary, it is a complex activity which requires specific times and actions

designed and thought out in order to facilitate and guide learning. Having times which precede assessment activities (*the preparation segments*) and which follow them (*segments of correction, communication and feedback of results*), and characteristics generated in the contexts of joint activities, where students can learn and show their self-regulation competencies, offer a framework which favors a move from external, supported regulation of learning to autonomous regulation of learning.

Our results contribute evidence on the variety of support and guidance that the teacher provides over the process. Most notable among the *a priori* supports to the assessment per se are the helps which contextualize and make sense of the assessment tasks, understanding assessment objectives and purposes, planning the study task and reviewing, studying for depth, and clarifying doubts. Among the *a posteriori* supports, we highlight efforts to communicate and share with students the assessment criteria, qualitative and not only quantitative assessment of results, offering written guidelines and guidance for assessing achievement of educational objectives from the didactic sequence, carrying out student actions for reflection on the process which was followed and what was achieved, as well as elements to be improved in the future. Together these provide the students with a collection of supports for learning self-regulation competencies and are evidence that self-regulation in assessment is not fostered by isolated actions but rather by a set of supports offered at different levels, at different times and with different purposes.

Finally, although further studies are required to identify the most specific characteristics of assessment situations which are most helpful in assisting students' regulation processes, results offered here offer a rough guide for creating powerful assessment settings where it is possible to help students become more autonomous in their learning through the contextualized teaching of self-regulation processes.

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Appendix 1
(original text in Catalan)

TEST ON MULTIPLES AND FACTORS: 6TH GRADE PRIMARY EDUCATION

1. a) How many factors does 10 have?
   b) How many factors does 17 have?
   c) How many multiples does 13 have?
   c) How many multiples does 20 have?

2. a) How can you know whether 195 is a multiple of 13?
   b) How can you find out through a different way that 432 is a multiple of: 9, 6 and 4?

3. a) Calculate:

3^3	$\sqrt{25}$	$\sqrt{10000}$
4^4	$\sqrt{81}$	$\sqrt{48}$
12^2	$\sqrt{144}$	
2^6		

   b) What relationship is there between powers and square roots?

4. Write using simplified notation:
   10.000.000, 546.000.000.000; 2.003.000.000.000.000; 1.000.000.000.000

5. Find all the factors of 12 and 36:
   10.000.000, 546.000.000.000; 2.003.000.000.000.000; 1.000.000.000.000

6. a) What is the multiple of a number?
   b) What is a prime number?
   c) What do we call numbers that are not prime?
   d) What is the exponent of a power?

7. Break down into prime factors: 144 and 624

8. Find the lowest common multiple of 8 and 10

9. Find the greatest common factor of 60 and 45

10. What could these things that we have studied be used for?

Appendix 2
(original text in Catalan)

MATERIAL FOR ASSESSING TEST RESULTS

1. Assessment record of test results

Name:	**Year in school:**
Subject:	**Assessment nº:**
Topic:	

Teacher observations

_____

Student observations (evaluate your work)

_____

You must discuss the test with your parents
Parent's comments and signature

Must be returned: ___ ____ ____

2. Student's test
(Include corrections and comments from the teacher)

3. Record of errors corrected on the test
(Include any rework on exercises that the student answered incorrectly)

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