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# Cognitive Work Developed By Students: From the Importance to the Promotion

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## Abstract

The task of promoting cognitive work is a school's most important task. Recent research, carried out in OECD countries, concluded that the differences between developing countries and developed countries in terms of educational policies should no longer be attributed to the number of years of compulsory schooling, but rather to suitable attention paid to the development of cognitive competences. However, learning situations and tasks distributed to the learners are not always sufficiently clear about the cognitive competences that they promote nor do they promote meta-knowledge within their procedures, which literature correlates to higher levels of school effectiveness; Thus, the present study seeks to explore how school subjects such as history and natural sciences develop curricular tasks that promote the development of cognitive competences. Research data come from 43 reports gathered from 43 history or natural science classes. The study concluded that there is a remarkable difference between the values obtained in the dimension of the importance of the studied tasks and the planned occasions for their implementation and evaluation.

**Key Words:** Cognitive work, learning tasks, curriculum development

## Introduction

The task of promoting cognitive work is a school's most important task. It has always been.

As Monsieur Hercule Poirot would put it, we must develop the little gray cells. We believe that all teachers and all subjects have this desideratum in mind, but some are more concerned than others about giving it shape.

The concern of the Centre of Life in Schools (OBVIE)[1], in studying this variable is on the one hand the need to study the learning experiences that are promoted within the

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[1] The Observatory of Life in Schools was created within the scope of the articulation between research and intervention that defines the action of the Centre for Educational Research and Intervention at the Faculty of Psychology and Educational Sciences. Its members, at present, consist of 18 Elementary and High Schools with which it develops joint projects. To learn more about OBVIE, access to the site www.fpce.up.pt/ciie/obvie.

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classroom and are intentionally designed by teachers to meet the objectives of their disciplines. On the other hand, it aims at drawing attention towards the often assumed, but rarely explicit dimension of curriculum development, by questioning the learning tasks that are offered to students in terms of thought processes they mobilize.

Cognitive strategies have been studied in combination with curriculum organization centred on student development, which is considered as a set of sequential steps that may be stimulated by the selected learning strategies (Inhelder & Céllerier, 1996; Morgado, 1988, 1997). A significant part of the constructivist-oriented literature is based on that conviction (Strauss, 2000). Furthermore, a considerable number of studies, which choose special education as their focus of analysis, works with these strategies in order to stimulate the cognitive development of students with learning disabilities (Feuerstein, Rand, Hoffman, & Miller, 1980).

However, it is common that educational systems, in the most general formulation of their goals, set the cognitive development of students as one of their priorities (Gonçalves & Machado, 1990). Therefore the curriculum guidelines that stem from this priority are equally sensitive to learning strategies, capable of promoting the development of cognitive competences in each student, either in group learning contexts, or at a more individual scale. Recent research, carried out in OECD countries, concluded that the differences between developing countries and developed countries should no longer be attributed to the number of years of compulsory schooling, but rather to suitable attention given to the development of cognitive competences (Hanushek & Woessmann, 2010).

It is possible to establish a connection between cognitive competences promoted in the classroom and the desired purposes of learning. The mediation between both is performed by learning strategies chosen by the teacher (Weinstein & Mayer, 1986), which range from simple repetition/test to the promotion of self-motivation for a greater capacity of autonomous learning. Between the two extremes, we can include elaboration, organization and metacognition. In fact, the teacher is essential for setting and implementing educational practices that may enable and enhance the cognitive development of students. Knowledge of educational practices held in school allows for understanding of the representations that teachers have on students' cognitive work and recommendations can be made in that regard. The role of pedagogical mediator that the teacher plays in curriculum development places him/her in a unique position to interfere with the cognitive development of students (Pereira, 2009). In almost all the consulted research it is possible to establish a link between academic success and the development of more complex cognitive competences, as is the case of metacognition (Ünal, 2010), and between higher levels of success and greater diversity in the use of differentiated strategies (Simsek & Balaban, 2010).

Another set of studies have associated learning strategies to the structures of thought that characterize the school subjects, and to the more specific ways that those school subjects have inherited characteristics from the scientific methodologies inherent to sciences, associated with those disciplines (Goodson, 2001; Praia, Cachapuz, & Gil-Perez, 2002; Mouraz Lopes, 2004). For that reason, logical-type competences may be expected in school subjects such as mathematics, or competences of hypotheses production associated in the school version of the exact sciences, or even more discursive competences, such as reading comprehension, more present in humanities or literature.

It is also interesting that the cognitive strategies are used to boost other learning outcomes, such as the feeling of success, perseverance, commitment or other actions (Simsek & Balaban, 2010). Another issue, which is not addressed in this text, concerns the relationship that may be established between the cognitive strategies used and the variables involved in curriculum construction. Examples of this are individual features, teaching methods, available time, available learning technologies, types of feedback provided by the teacher, degree of demand regarding the proposed learning tasks, or even the evaluation criteria and evaluation tools used.

The strategies are the knowledge of procedures, and the knowledge of how to carry out a particular task. When applied to the cognitive domain, strategies assume knowledge of the operations that allow decoding a word, understanding a given reasoning, or building a coherent argument. This type of knowledge differs from declarative knowledge, the knowledge of facts, but it does not exist without them (Pressley & Harris, 2009). Moreover, strategies assume a dimension of intentionality that needs to be appropriated by the agent, in order to be effective.

However, learning situations and tasks distributed to the learners are not always sufficiently clear about the cognitive competences that they promote, nor develop that meta-knowledge about the procedures that literature correlates to higher levels of school effectiveness (Enfield et al., 2007).

Thus, the present study seeks to explore how school subjects such as History and Natural Sciences develop curricular tasks that promote the development of cognitive competences.

## Methodology

### Study Group

The empirical work carried out used a non- probability sampling, called an occasional sample, composed of one teacher and one natural science class from each of the grades in the 2nd cycle of Elementary Education, and one teacher and one history class from each of the grades in the 3rd cycle of Elementary Education. Those two courses were chosen as they arise from the broad tendencies which shape curriculum design: the Natural Sciences and the Human Sciences. In each school, teachers were selected among those who teach selected courses and they were available to do reports concerning their practices. The procedure was proposed to each of the schools associated with the School Life Observatory (OBVIE). The period under analysis consisted of one full week of classes. The data collection period was the spring term of the 2009/2010 academic year.

### Data Collection

Data was collected by self report of 43 of the teachers being studied. To do this report, a guideline protocol was developed that focused on cognitive work proposed by teachers to their classes. The content of the reports refers to both teachers' practices as well students' tasks during the observation period.

Data were collected from 43 classes/43 teachers, spread across the two subjects under study: Natural Sciences (NS) and History.

The cognitive tasks under analysis are the ones usually considered to be linked to cognitive development and may also be associated with school tasks: analysis; synthesis; comparison; analogy; deduction; induction; problem formulation; hypotheses formulation; experiment planning; identification of correlations; production of specific statements; production of general statements. Teachers were asked to report, for each of the mentioned competences, the degree of importance of related tasks in their subject and the grade that utilized this type of task. A second dimension was related to the task request and, finally, tasks were examined concerning their degree of difficulty and their result, viewed according to the effectiveness of their implementation. This triple dimension of the script protocols sent to the teachers aimed at analysing the difference between the importance, frequency and effectiveness of tasks associated with the aforementioned cognitive strategies over the considered period. The basic assumption of this operationalization of cognitive tasks is that they align directly with the competences to be developed, that is, a task of analysis involves the development of competences of analysis, and so forth. To address the importance ascribed to tasks, as well as the degree of difficulty and the results, a scale ranging from 1 to 5 was used. Nevertheless, the descriptors of the degree of difficulty ranged from "Very easy task" (1) to "Very demanding task" (5), and the descriptors of the outcome ranged from "All students performed the task without help and with ease" (1) and "Most students could not perform the task without help" (5), which are inverse responses.. Finally, in the actual request tasks, a description of the instruction given to students during their performance was requested.

**Data analysis**

As reports provided both quantitative as qualitative data, analysis did reflect this double dimension. Quantitative data were processed by use of SPSS (Statistical Package for the Social Sciences). The description of the operationalization of the work proposed to students, given their small size, has been subject to content analysis aimed at explanation.

## Results

### Importance of Cognitive Tasks in Curricular

The following table refers to the number of responses given by teachers from the school subjects under analysis on the importance of those cognitive tasks in the work expected of students in the subject.

**Table 1.** Distribution of the average values of the importance ascribed to the cognitive strategies according to the study subjects.

| | case | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Natural Sciences | | | History | | | Total | | |
| | Mean | F | Std. Deviation | Mean | F | Std. Deviation | Mean | F | Std. Deviation |
| I analysis | 4.33 | 18 | .686 | 4.60 | 25 | .500 | 4.49 | 43 | .592 |
| I synthesis | 4.35 | 17 | .702 | 4.67 | 24 | .482 | 4.54 | 41 | .596 |
| I comparison | 4.06 | 18 | .639 | 4.13 | 23 | .626 | 4.10 | 41 | .625 |
| I analogy | 3.93 | 15 | .594 | 3.82 | 17 | .809 | 3.88 | 32 | .707 |
| I deduction | 3.94 | 16 | .854 | 3.31 | 13 | .947 | 3.66 | 29 | .936 |
| I induction | 3.62 | 13 | .650 | 3.09 | 11 | 1.044 | 3.38 | 24 | .875 |
| I problem | 4.24 | 17 | .831 | 3.46 | 13 | 1.050 | 3.90 | 30 | .995 |
| I hypothesis | 4.06 | 17 | .748 | 3.50 | 12 | 1.243 | 3.83 | 29 | 1.002 |
| I planning | 4.12 | 17 | .928 | 2.38 | 8 | 1.506 | 3.56 | 25 | 1.387 |
| I correlation | 3.86 | 14 | .663 | 3.46 | 13 | .776 | 3.67 | 27 | .734 |
| I specific statement | 3.19 | 16 | 1.328 | 2.74 | 19 | 1.284 | 2.94 | 35 | 1.305 |
| I general statement | 3.38 | 16 | .957 | 3.00 | 20 | 1.338 | 3.17 | 36 | 1.183 |

Evidence from the analysis of the above table regards the cognitive tasks to be developed by students that teachers consider fitting in the work carried out in the respective areas of study. The analysis, synthesis and comparison are the tasks considered more important by both groups of teachers; those aspects presented almost no missing values, an also had a smaller dispersion. In general, all the tasks listed were mentioned as important by science teachers, while history teachers emphasized the previously mentioned competences as well as the production of analogies, the production of hypotheses and the establishment of correlations.

However, history teachers ascribe more importance to the analysis and synthesis than their counterparts from sciences, whereas the latter give more value procedures of inductive and deductive reasoning than the former, as well as problem statements and experiment planning. The differences found in results concerning these two items are statistically significant (t = 2.18 and 3.01, respectively, $p<0.05$). Such discrepancies evaluate the two possible interpretive forms: those who think the task is relevant from the standpoint of the subject and which value (ordered from 1 to 5) they assign to it.

**Table 2.** Comparison among importance of cognitive strategies and related required tasks

| | F Importance | F Required tasks |
|---|---|---|
| Analysis | 43 | 39 |
| Synthesis | 41 | 31 |
| Comparison | 41 | 30 |
| Analogy | 32 | 14 |
| Deduction | 29 | 17 |
| Induction | 24 | 14 |
| Problem | 30 | 21 |
| Hypothesis | 29 | 11 |
| Planning | 25 | 11 |
| Correlation | 27 | 22 |
| Specific statement | 35 | 19 |
| General statement | 36 | 12 |

This figure refers to the importance of strategies and the existence of tasks requested of the class in the considered time period. Again, except for analysis, synthesis and comparison, the occurrences of the requested tasks are far fewer.

### Results of the Cognitive Tasks Required of Students in Their Subject

**I - Degree of difficulty (RD).** The following table refers to the degree of difficulty ascribed **by the teachers of the subjects** to **cognitive tasks** proposed to the students in their subject and in the period considered.

The tasks planned by the teachers generally involved an accessible degree of difficulty for those who were paying attention. The most difficult tasks related to the production of inductive reasoning and to the production of hypotheses. The proposed tasks considered easier were the production of correlations and the production of syntheses. Occasionally, history teachers included complex tasks, but this was not a significant difference. Unlike what had been recorded in the table summarizing the importance ascribed to cognitive strategies, in this table there is a greater degree of dispersion of responses, indicating a greater heterogeneity of the degree of difficulty of the tasks.

**Table 3.** Average degree of difficulty of the tasks proposed to the students, according to the considered cognitive competences and the subjects.

| | case | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Natural Sciences | | | History | | | Total | | |
| | Mean | F | Std Deviation | Mean | F | Std Deviation | Mean | F | Std Deviation |
| RD analysis | 2.71 | 14 | 1.069 | 3.04 | 25 | .889 | 2.92 | 39 | .957 |
| RD synthesis | 2.50 | 12 | 1.087 | 2.89 | 19 | .937 | 2.74 | 31 | .999 |
| RD comparison | 2.77 | 13 | .599 | 2.76 | 17 | .752 | 2.77 | 30 | .679 |
| RD analogies | 3.33 | 6 | .516 | 3.38 | 8 | 1.408 | 3.36 | 14 | 1.082 |
| RD deduction | 3.33 | 9 | 1.000 | 3.75 | 8 | .886 | 3.53 | 17 | .943 |
| RD induction | 3.67 | 6 | 1.211 | 3.75 | 8 | 1.035 | 3.71 | 14 | 1.069 |
| RD problem | 2.77 | 13 | 1.481 | 3.88 | 8 | 1.126 | 3.19 | 21 | 1.436 |
| RD hypothesis | 3.33 | 9 | 1.000 | 4.00 | 2 | .000 | 3.45 | 11 | .934 |
| RD planning | 2.71 | 7 | 1.113 | 3.50 | 4 | 1.291 | 3.00 | 11 | 1.183 |
| RD correlation | 2.33 | 9 | 1.000 | 2.92 | 13 | 1.188 | 2.68 | 22 | 1.129 |
| RD specific statement | 3.00 | 7 | .816 | 3.00 | 12 | 1.279 | 3.00 | 19 | 1.106 |
| RD general statement | 3.20 | 5 | 1.304 | 2.57 | 7 | 1.397 | 2.83 | 12 | 1.337 |

*1 means "The task was too easy"; 2 means "The task was easy for those who are usually good students"; 3 means "The task was easy for those who were paying attention"; 4 means "The whole task was globally difficult"; 5 means "The task was very demanding".*

**II - Results obtained in the tasks (RR).**

**Table 4.** Average degree of results obtained in the tasks proposed to students according to the considered cognitive competences and subjects.

| | case | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Natural Sciences | | | History | | | Total | | |
| | Mean | F | Std. Deviation | Mean | F | Std. Deviation | Mean | F | Std. Deviation |
| RR analysis | 3.00 | 12 | 1.206 | 3.11 | 19 | 1.243 | 3.06 | 31 | 1.209 |
| RR synthesis | 2.60 | 10 | 1.174 | 3.50 | 16 | .966 | 3.15 | 26 | 1.120 |
| RR comparison | 2.64 | 14 | 1.008 | 3.05 | 19 | .848 | 2.88 | 33 | .927 |
| RR analogy | 2.89 | 9 | 1.364 | 3.45 | 11 | 1.368 | 3.20 | 20 | 1.361 |
| RR deductions | 2.75 | 8 | .886 | 3.33 | 6 | 1.033 | 3.00 | 14 | .961 |
| RR inductions | 1.67 | 6 | 1.033 | 3.60 | 5 | 1.673 | 2.55 | 11 | 1.635 |
| RR problem | 3.42 | 12 | 1.240 | 3.00 | 8 | 1.512 | 3.25 | 20 | 1.333 |
| RR hypothesis | 3.50 | 8 | .926 | 2.25 | 4 | .500 | 3.08 | 12 | .996 |
| RR planning | 2.40 | 5 | .548 | 4.00 | 1 | . | 2.67 | 6 | .816 |
| RR correlation | 3.00 | 3 | 1.000 | 3.33 | 6 | .816 | 3.22 | 9 | .833 |
| RR specific statement | 4.00 | 2 | .000 | 4.00 | 6 | .894 | 4.00 | 8 | .756 |
| RR general statement | 4.00 | 2 | .000 | 3.80 | 5 | .837 | 3.86 | 7 | .690 |

*1 means "All students performed the task without help and easily"; 2 means "The majority of students was able to perform the task without help"; 3 means "Some students were not able to perform the task without help"; 4 means "About half the students failed to perform the task without help"; 5 means "Most students were not able to perform the task without help".*

Given the small volume of data, conclusions are hardly an expression of a general trend. Yet, we may find that almost all the tasks listed, since they obtained average values ranging between (2.55 and 3.25), are still tasks that some students perform only with help. The production of statements, whether general or specific, seems to be a much more difficult task, but given the low level of reported occurrences, we cannot identify it with a trend.

There are some significant differences between the two subjects in the results of the tasks of synthesis, inductions and hypotheses proposed to students (respectively $t = 2.03$; $t = 2.25$ and $t = 3.0$, for a $p < 0.05$), with the distinction being favourable to the subject of history in the production of syntheses and inductions.

**Comparative Analyses of the Degree of Subject Importance of the Competences Crossed with the Degree of Difficulty of the Performed Activities and Their Results**

**Cross comparative analysis of the analysis competence.** In the particular case of the analysis, it was found that this task is relatively important for the development of the subject of sciences, with the tasks proposed by the teachers presenting an accessible level of difficulty for a usually good student, and most students achieved the tasks.

An example of a proposed task was as follows: "Observation of an onion's epidermal cells under the microscope and elaboration of the preparation according to the protocol", "which is, an easy task for those who are, usually, good students, and hence, most students were able to carry it out without help".

Concerning the subject of history, to analyse is a very important cognitive task, accessible to anyone who pays attention; thus, some students could not perform the task. An example of a proposed task was "students analysed a text to characterize the period of time under study".

**Cross comparative analysis of synthesis competence.** Similarly to the cognitive task of analysis, synthesis has also obtained analogous results. It is important for the development of the subject of sciences, as the tasks proposed by the teachers presented a degree of difficulty that is accessible to anyone paying attention, and most students performed the tasks without help. The following was an example of synthesis work: "They answered questions that summed up the topic, summarizing what was most important".

Summarizing is a very important cognitive task in the subject of history as well, and it is, accessible to anyone paying attention, but a considerable number of students failed to perform the task without help.

**Cross comparative analysis of the comparison competence.** For both disciplines analysed, comparing is an important cognitive procedure, that anyone paying attention can perform, so some students (except in history) could not perform the task without help. The following is an example of that task, which was more difficult for some of the students in the 7th grade: *Comparison of documents or historical information.*

**Cross comparative analysis of the analogy competence.** Analogies, although relatively important in the curriculum implementation of the subjects considered, require the attention of students in both cases, but are of differing access to students of both subjects. It seems that the procedure is more difficult for history students. However, if in the analysis of some sciences procedures, the analogies seem to assume their full specificity, in other cases, particularly in history, analogies are seen as simple comparisons of "contents with current issues".

**Cross comparative analysis of the deductive competence.** Deductions were considered relatively important by 19 teachers, but their execution was substantially reduced and more difficult.

**Cross comparative analysis of the inductive competence.** Inductions were considered relatively important by teachers, but their execution was very low (only 14 occurrences) and with uneven results across the two subjects. Additionally, an explanation of the operationalization of the tasks was absent from the reports received.

**Cross comparative analysis of the competence to formulate problems.** Formulating problems was considered very important by 21 teachers. However, the execution was scarce, because it corresponded to more work and determined the fact that some students had not been able to carry it out without help.

Examples of problem formulation tasks were as follows, respective of the two fields of knowledge under study: *Each group of students formulated a problem about premature sexual experiences* (NS - $6^{th}$ grade) *and students problematized historical situations / facts* (History – $9^{th}$ grade).

**Cross comparative analysis of competence to formulate hypotheses.** Formulation of hypotheses had greater prominence in the subgroup of Natural Sciences, both in the number of responses and in the degree ascribed. However, the performance fell short of the importance ascribed.

An example of this task was the *formulation of disenses hypotheses and consequences.* – $6^{th}$ grade)

**Cross comparative analysis of the competence of planning experiments.** Planning of experiments is a very important subject strategy for NS teachers, The opposite of which is true for history teachers. However, even in the case of NS, the performance falls short of the importance. Furthermore, it seemed to us that experiment planning is not a task to present to students, but rather to be replicated by them, as the following example shows: *Supply of protocol to arrange the preparation*. (NC - $5^{th}$ grade)

**Cross comparative analysis of the competence of identification of correlations.** Establishment of correlations is a rather important cognitive task, and with a low degree of difficulty for those who have been paying attention. However, the number of reported cases is very low.

An example of such a task was the proposal for *identification of correlations between facts/ situations/ documents* requested to the $8^{th}$ grade History students. From those, "nearly half failed to accomplish the task without help".

**Cross comparative analysis of the competence to produce specific statements.** Production of specific statements is not considered as a globally important task for teachers of the surveyed subjects. This led to the less reference to performed activities.

**Cross comparative analysis of the competence to produce general statements.** Production of general statements is considered to be a task of medium importance for the teachers. However, there is a noticeable difference if we compare with the figures related to activities organized for their promotion and evaluation.

## Discussion of Results

The data collected allow for the general conclusion that analysis, synthesis and comparison are considered the most important tasks by the surveyed teachers. Given that the results for these three tasks do not allow us to conclude about any differences between the groups of teachers formed according to the subjects taught, it is possible to infer that these are the basic and easier competences, for which successful use only requires attention. Formulating problems, making hypotheses and planning experiments are the other cognitive competences most valued by sciences teachers, in a clear adjustment to the algorithm of the experimental method. Such results are consistent with the idea that curricular work is also carried out as a way to include students in the methodological schemes that are distinctive of sciences to which the school subjects relate, and that this is important in the representation that the teacher makes of their importance (Praia et al., 2002), even if there is not a match, in practice, with the tasks proposed to students in the classroom. Concerning the production of analogies, deductive and inductive reasoning, as well as the establishment of correlations, it is not possible to find a relation with the specific uses of each of the subjects under study. Somehow, they are logical procedures that require greater specificity and knowledge of the rules of their production and that are not part of the explicit methodological approaches of those subjects along the pathway they cross until the 9$^{th}$ grade (unlike what happens with the application of experimental procedures in natural sciences). Our interpretation, which explains the lower prevalence of proposed tasks to build these competences, results from the fact that most teachers believe that the repeated use of a set of procedures is the most appropriate way to acquire the respective competences, without further need to reflect on the performed work; this interpretation is consistent with the research carried out by Simsek and Balaban (2010). Moreover, the minor importance ascribed to the production of statements (both general and specific) may possibly be explained by this minor importance ascribed to procedures that are metacognitive in nature: after all, the issue of general or specific statements and their importance implies their dimension of proof and derives from the conditions of their production. If the curricular work is mainly oriented towards the transfer of information and less to the legitimacy of the knowledge conveyed, such strategies significantly lose importance.

In all the studied strategies, there is one notable difference between the values obtained in the dimension of the importance of the studied tasks when compared with the planned occasions for their implementation and evaluation. It might be argued that the methodological procedure reduced the period for the collection of occurrences relating to the work of the cognitive competences to one week. This includes about 3 or 4 hours of classes, in each subject, selected as regular classes. Therefore, the assumption was that in regular classes, normal cognitive work is carried out, and hence, if this does not happen it is due to the fact that the subject, although considering it important, privileges other modes of learning that are not based on the work required of students. It is possible to infer that this discrepancy reflects a primacy of lectures, in which students are only asked to see/and hear. Even if this inference is not necessary, it is, , possible.

## Conclusion

The study analysed the ways in which school subjects such as history and natural sciences develop curricular tasks that foster the development of cognitive competences.

The number of respondents hinders general conclusions; hence, the following conclusions refer only to the cases under study.

Notwithstanding this caveat, it could be concluded that:

1. Analysis, synthesis and comparison are the tasks deemed most important by both groups of teachers, formed according to the school subjects they teach. Formulating problems, making hypotheses, and deducing consequences are the other cognitive competences most valued by science teachers, reflecting a clear adaptation to the algorithm of the experimental method.

2. There is a remarkable difference between the values obtained in the dimension of the importance of the studied tasks and the planned occasions for their implementation and evaluation.

3. Concerning the result of the proposed tasks, it was possible to conclude that if students are paying attention, most of them can succeed in their execution, without extra help. The exception to this rule is the formulation of statements, both general and specific, as they are tasks that about half the students can perform only with assistance.

Considering these results, it is relevant to ask whether the way teachers create work the curriculum is likely to enhance the development of cognitive strategies in an intentional manner, whether teacher training has taken that into consideration, and whether the discourse on competences is not still a half empty place, that is, without procedural content. Another issue, which results more from the literature than from the data collected, is the question about adequate time to develop strategies that promote the metacognition... Why can logical procedures of thought not always be part of the curriculum work?

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