

## **EXPERIMENTAL DATA ON THE ROLE OF METACOGNITION IN GAINING SELF-ASSESSMENT COMPETENCE OF HIGH SCHOOL STUDENTS**

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**ABSTRACT.** Within a learning sequence, for solving a task given by the teacher himself or assumed by the student himself, this verifies at the same time, knowledge, capacities or general abilities necessary to solve a task, but also, metacognitive knowledge, capacities and abilities, which allow him to control monitor and regulate an activity performed, achieving at the same time actions which allow him to self appreciate, self evaluate.

In this study, we are analyzing the implications which the development of the metacognition has in forming the self evaluation competence of the high school student. We are presenting the results of an experimental research, within which we intended to demonstrate the dependency relationship between metacognition and evaluation.

**Keywords:** metacognition, competence assessment, self control, self regulation, self monitoring.

**AUSZUG.** Innerhalb einer Lernphase werden bei der Lösung einer Aufgabe, die vom Lehrer beauftragt- oder von dem Schüler selbst erstellt wurde, die allgemeinen Kenntnisse, Fähigkeiten und die Fertigkeiten sowie die metakognitiven Kenntnisse, Fähigkeiten und Fertigkeiten von dem Lernenden gleichermaßen verwendet, die für die Lösung einer Aufgabe notwendig sind. Diese ermöglichen ihm eine Selbstkontrolle, eine Überwachung, eine Anpassung der vorgenommenen Aktivitäten zu realisieren und gleichzeitig Handlungen durchzuführen, die eine Selbsteinschätzung, Selbstbewertung ermöglichen. In dieser Studie analysieren wir die Auswirkungen, die durch die Entwicklung der Metakognition auf die Kompetenzentwicklung der Selbstbewertung bei den Gymnasiasten auftreten. Wir präsentieren Ihnen die Ergebnisse einer experimentellen Forschung, in denen wir die Abhängigkeitsbeziehung zwischen Metakognition und Selbstbewertung zu demonstrieren verfolgen.

**Schlüsselwörter:** Metakognition, Selbstbewertungskompetenz, Selbstkontrolle, Selbstanpassung, Selbstüberwachung

### **1. Metacognition issues. Importance and timeliness**

The efficiency of any activity undertaken by the individual is provided largely by the possibility of stimulation and turning to account the metacognitive

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capacities. Most times, success is determined by the possibility of monitoring, controlling, regulation of own activities. Representing knowledge of knowledge, a knowledge of the act of knowledge, metacognition accompanying learning activities, giving the learner the opportunity to reflect on it and collect information useful for a specific work, activity for other future ones. Metacognition involves not only knowledge but that we collect in connection with the student's own cognitive activity, but requires the use of control and regulation mechanisms. Metacognition involves making the learner conscious of his own mental activity.

Given the role that metacognition plays in student work through training process monitoring, control, regulation, we considered necessary and useful to take into discussion the relationship which is established between metacognition and self-evaluation, this in turns assuming self-analysis, self control, self regulation. Thus we infer that an important direction in trying to develop opportunities for self-assessment is made by involving, stimulating metacognitive capacities. In the classroom, the teacher has the opportunity to use the many situations to develop students' metacognitive capabilities, they, like many other types of capacity could be formed and developed with practice by placing students repeated stimulating situations.

The exploitation of metacognition in the work done by students is obvious and has immediate implications in achieving self-assessment as:

- favor analysis and awareness of their cognitive approach taken, of their actions, operations;
- allows identifying and defining the steps taken in solving a given task, awareness of the sequence, order and chaining them to identify the characteristics of each stage separately;
- ensures the identification of their inaccuracies, errors, failures and the causes which have generated, creating the possibility the student to avoid their repetition in future cases;
- provides the identification of their successes, successes and formulate generalizations of lessons conclusions about how to operate in future similar situations;
- allows comparison of the approaches made to various disciplines, establishment of similarities, differences, the setting of the efficient constant action, procedural, methodological, transdisciplinary, successful;
- creates opportunity for selection of the most efficient learning techniques, from a specific learning situation;
- favor drawing conclusions on the most efficient strategies used in solving a task, to make a decision;
- favor the transfer of knowledge (intradisciplinary and interdisciplinary), their use in other contexts than those in which they were acquired (Doly, 2002), through a better knowledge and their construction;

- allows the anticipation of obstacles, some difficulties, but also the design of efficient steps to eliminate them;
- allows comparisons between the personal work and achievements and those of the colleagues, thereby enhancing self-knowledge, knowledge of his/her own limits, his/her place in the community;
- contributes to the improvement of the learning process, especially for students in difficulty (Grangeat, 1999; Doly, 2000);
- allows the development of autonomy, the independence of the learner, due to the possibility of acquiring their own strategies for verification, control, this being an important condition for success in the learning process;
- facilitate training and development of the appropriate motivation for learning and the development of self-consciousness.

## **2. The purpose and the objectives of the research**

This pedagogical improvement research aims to develop meta-cognitive capabilities, in order to achieve a self control, a self regulation, a self monitoring, a more objectively self-evaluation made by high school students. Research objectives can be shown on each stage of it: *The certifying stage*:

- Identifying the opinion of students and teachers from high school education towards the role of metacognition in shaping the power of self-assessment for high school students;
- Knowledge of methods used by teachers to train students for self-assessment, to stimulate self evaluative opportunities available to students, their previous experience on this issue;
- Identify ways used by teachers to stimulate and train students metacognitive capacities;
- Recording the results achieved by the students, at the school subject "Romanian language and literature".

*For the experimental stage, (the formative intervention):*

- The development of a formative intervention program, in collaboration with teachers in experimental classes, its implementation;
- Tracking the progress of students from experimental classes compared with those of students of control classes, by repeating the set of assessment tools;
- The establishment of efficiency of the training tools used in the stage of formative activities (tests, rubrics, handouts, self-assessment questionnaires, the exploitation of metacognitive capacity, etc..), for the development of the metacognitive and self-evaluation capacities;
- The registration of difficulties, obstacles aroused in the process and identification of some ways to overcome them;
- The formulation of new hypotheses, ways of action, strands, depending on conducting research.

*For post- and re-test stages*

- Recording the results of two sample subjects (experimental and control) and making comparisons between them, at the same stage of research, but also in the same sample (either experimental or control), at different times of the research (pretest, experimental stage, posttest, re-test);
- Identifying the implications of developing metacognitive capacities of students on gaining self-assessment competence.

### **3. Basic assumption of the research**

The conducted research was guided by the following general hypothesis, which we planned to test in the educational practice.

The frequent use, in the act of teaching, of some methods and tools for training the metacognitive capacities of students is able to determine the formation of self-assessment competence and to increase the efficiency of their activity, improving the educational realization.

### **4. Independent and dependent variables**

In the present research, the independent variables refers to all procedures proposed and presumed to be efficient for high school students in their development metacognitive capacity (scales, questionnaires, personal diaries). It is clear that these variables were introduced only to classes in the experimental group and not in control group.

By reporting to the independent variables, the dependent ones clearly represent "the impact and results recorded by the introduction of independent variable, namely to produce the change" (Bocoş, 2003, p. 66). In other words, these variables are the results obtained by means of the introduced change, their value having to aim to confirm or not the working hypothesis established.

The dependent variables, from the present research, are the results of the tests, grids, schedules, instruments applied to the students, and their results at the school subject "Romanian language and literature".

### **5. The place and time of the research**

The research was conducted in a few high schools from Dolj, Mehedinți and Teleorman, being selected the students from ninth and tenth grade of these schools. The experimental approach itself, of improvement type in this case, based on a solid theoretical approach, consists in following these stages:

- The pre-certifying stage;
- The certifying stage / pre-experimental stage / Pretest;
- The experimental stage;
- The post-experimental stage / fast;
- The re-test stage.

The present research was conducted during three years of school, namely 2004-2005, 2005-2006 and 2006-2007. The staggering stages throughout this time span, and the important objectives pursued in each stage are listed below:

### **6. The sample of subjects**

It was composed of students of IX and X grade and teachers from 6 high schools from Mehedinti, Dolj and Teleorman. Subjects were selected by randomization at several stages. The representativeness was achieved by the large number of subjects, by the selection of classes from different profiles, taking into account the insurance of equivalence in terms of profile, for both types of samples: experimental and control, so each of the two types of samples should include classes of the same profile. This was also a condition to ensure sample homogeneity, along with the ones that have considered the intellectual level and the academic performance of students at the school subject "Romanian language and literature". In this regard, it has been applied an initial test to all these classes and also there were recorded the entrance grades of the students at the same school subject (only for students of ninth grade) and the averages obtained at this school subject in the previous year (only for tenth grade students). Also as a landmark, to ensure the homogeneity of the two types of samples, there were taken into account marks obtained by students up to that point.

### **7. Sample content**

Generally speaking, the sample content refers to the scientific content which will be exploited in the research. It must be related with the chosen theme, with the present field, with the objectives and the hypothesis of the research. It must also be related to the curriculum framework and with the reference objectives of the school subject which is the subject of experimental activities, and to be updated with the new amendments specified in official curricular documents. Choosing this content also depends on the personality and experience of the researcher, the psychological characteristics of the subjects involved the psychosocial characteristics of the environment in which they work, and also on the material, financial, ergonomic resources available.

The scientific contents used were in accordance with the curriculum for "Romanian language and literature", IX and X grades, the themes chosen were both language and literature themes.

We specify that in addition to the content used in the classroom, there were also used scientific content on the issues of self assessment tools, to help students to self-verify, self-note, self-control themselves in order to monitor and adjust their cognitive steps taken in learning activities.

### **8. Research Methodology**

In our research, we used the following research methods: observation, self observation, investigation based on questionnaire, investigation of curricular

documents and other official school documents, the analysis of students work products, pedagogical knowledge tests (these methods have been used in all stages of research), psycho-pedagogical experiment (only used in the experimental stage), statistical methods for processing and interpreting the research results.

Among these methods, we insist on psycho-educational experiment, giving, in short, learning activities undertaken by students. The psycho-pedagogical experiment consisted of activities in which students were trained to build meta-cognitive skills. There have been used different models, methods, tools to stimulate the meta-cognition presented below. Thus, during the course of the experiment, we sought:

- The use of specific training programs in explicit awareness of learning strategies;
- The training of self monitoring and self-evaluation for self-regulation;
- The education of self motivation;
- The initial assessment and the explicit formulation of tasks and criteria for implementation and completion;
- The periodic self-assessment;
- The explicit tracking progress and the method to overcome difficulties;
- The own checking of the methodology in order to obtain performance;
- The use of a learning journal;
- The involvement in discussions with the subject teacher or peers;
- The appeal to a continuous feedback;
- The practice of self-assessment level of understanding;
- The self appreciation of outfit to scientific problems and others. (apud Joița, 2006, p. 190).

The teachers of the experimental classes have created different and multiple situations in which students should be able to capitalize on metacognition. These situations either preceded the learning activity, or they were simultaneous with it, or post learning. Here are a few examples from the first type:

- the assessment of the level and quality of students previous knowledge and capacities, skills, needed competences to solve new tasks;
- the assessment of difficulties, of obstacles they have already encountered in similar learning activities and the ways of overcoming, removing them;
- anticipation of the degree of difficulty of the task that students are to solve;
- the appreciation of success degree through determination of the expectations, aspirations level and opportunities of their own, between the objectives given by the teacher and the potential each student has;
- the inventory of strategies, practical ways of approaching and solving the task proposed, based on previous experience;
- time anticipation for solving the required proposed task;
- appreciation of attitude, motivational levels on the new workload / activity to be trained;

- establishment of a learning activity goal to be undertaken by the students themselves;
- appreciation of a theoretical contribution and / or praxiologic task / activity the students are to solve / undertake and others.

During the learning activity, metacognitive skills were involved in situations such as:

- Students comparison of the response given by the students using the textbook or other support material or those of colleagues;
- Reporting the response to the criteria given by the teacher;
- Identifying their own mistakes or those of a colleague, from a given response;
- Summarizing a text or a document;
- Identify key words from a text;
- The wording in their own language, of ideas, thesis, theories;
- The explanation, the argumentation, the analysis of a colleague's response;
- Construction during the course work, of a scheme which would give synthetically the taken steps;
- Awareness and recording of the progress made during the activity with reference to criteria imposed on colleagues achievements, in its own work, considered from different temporal perspectives;
- Proper management of time allocated for solving the proposed task;
- Explanation, argumentation of ideas, theories, etc.

At the end of the learning activity, students were able to capitalize on metacognition in situations such as:

- Assessing the difficulty level of the task performed;
- Identifying difficult moments, and those that have been easily overcome in solving the task;
- Assessing the knowledge acquired from completed learning experiences;
- Establishing clearly the blur incurred in acquiring new knowledge;
- Identifying issues or elements to be incorporated in future learning activities, to ensure proper and full acquisition;
- Identifying the usefulness of knowledge acquired;
- Appreciation of the efficiency of strategies used in solving the task;
- Identifying the opportunities to integrate new acquisitions into already existing notional systems;
- Drawing conclusions on the learning style efficiency of the student and others.

In the specialty literature, there have been outlined recently, numerous models of training aimed at training and developing students' metacognitive skills explicitly or implicitly. Of these, we can remind (apud Joița, 2006) several models which have been used in formative activities conducted by students:

- **The E-R-R** (Evocation-Making sense-Reflection) - each of the initials that name this model represents one step in the process of building the knowledge by the student. Therefore, the **Evocation** corresponds to the time of updating and valorising the previous experience or knowledge, **Updating** -the meaning corresponds to the learning sequence itself, represented by the actions of research, exploration, investigation, analysis, restructuring, combining, commissioning correlation, reasoning, evaluation. Last sequence, the one for the **Reflection**, is assumed to appeal to metacognitive capacities for awareness of their cognitive approach undertaken for identifying the errors, difficulties, obstacles, as well as the solutions adopted to overcome them, in order to draw conclusions, make assessment.
- **Model of the 5 E** - is one of typical training patterns revealing constructivist idea that learning is not a linear process but a complex one, structured in several stages, each involving deepening, nuance, extrapolation, returns. Such learning, realized progressively involves both, the simple thinking but also of the complex, superior ones as well as the metacognitive. Each of the 5 E is illustrative for the capabilities they entail, being also considered stages of learning: **Engage** (employment), **Explorer** (direct exploration), **Explain** (explanation, argumentation), **Elaborate** (drafting, generalization) **Evaluated** (evaluation). Each of these steps involve actions of the students, from those regarding the theme or problem orientation, problem identification, to the exploration, research, investigation, then analysing, comparing, generalizing, and, finally, the assessment, evaluation of progress achieved in the last step in particular, students then could practice their metacognition;
- **The ETER** (Experience, Theory, Experimentation, Reflection) - the last step in particular, provides opportunities to stimulate metacognitive capacities, through reflection;
- **The CETP / SIS** - like the 5 E model, this model also proposes implementation of a constructivist learning on 6 separate stages, each stage involving the production of specific actions such as updating knowledge on that topic or issue, identifying and analysing the necessary information (first stage), identification of errors, misunderstandings, prejudices on the issue called into question, making them the starting point of the problem- situations, the formulation of hypotheses (for the second stage), implementation of new knowledge, concepts and “anchoring” of their predecessors (the third stage), making associations, correlations, allowing a better fixation of new knowledge (fourth stage), making personal reflections about the undertaken approach, the actions undertaken, completed (The Fifth Stage); realizing some opening to other situations to allow the continuation of what was done (last stage).

Those models contribute indirectly to stimulate metacognition students, especially through training personal reflection. There are also models that aim explicitly at stimulating the student metacognition with a view of developing it.



Such a model is the metacognitive facilitation formulating questions (White and Frederiksen, apud Joița, 2006) and contributing to the formation of the scientific thinking in the constructivist style, of knowledge through research. As tools intended to be used there are three categories of questions to take into account: questions about how to build, design of the knowledge activity (their role is to facilitate the students learning of steps, methods, conditions in which the scientific knowledge takes place), questions about control, assessment based on reflection (regarding their own learning activity, quality, efficiency, steps taken, difficulties encountered, the organization and management of the actions, methods and tools used in learning) questions on general aspects of knowledge and reflection on it (they are used especially for repetitive situations, students are now able to formulate their own questions).

To stimulate highschool students' metacognitive skills and capacities of, has been used a variety of instruments: criteria analysis records, books of records and reflections, thematic papers prepared in the self-critical spirit, self-portraits, reviews of resolving situations, comparative analysis on issues of metacognition evolution, own evaluation guide, evaluation annotation on the learning of manual or from other sources, self-assessment scales on metacognition issues, comparing the auto-evaluation with the standardized evaluation, comparative and dynamic, mistakes and causal analysis, the self evidence of the successes and the helpful factors, analysis of the sociometric techniques applied to the group (Joița, 2006, pp 242-243). These instruments are available especially for older students as high school students, which manifest better the possibilities of self control, self monitoring, self-organization, self-regulation, self stimulation learning activity.

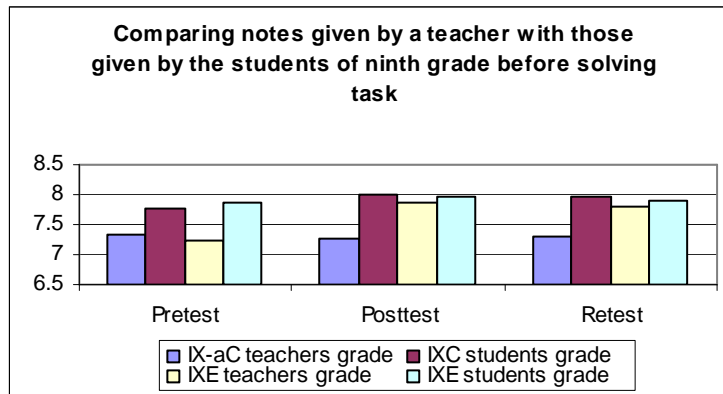
An efficient and easy to use instrument is the *diary* in which students can record various relevant aspects of their activity (eg "What are the steps taken to solve the task X "?, "What are the obstacles for solving the difficulties encountered during the task?", " How were these difficulties overcome?", "Which are the successes of this approach taken?", "How can they be recovered in other activities?" etc...). Students used to bring forward relevant aspects of their learning, to bring forward the importance of substantial analysis, reflections on it, which will allow an effective control.

All these models, methods, tools have been used successfully in the work with the, adolescents, given that all variables of the training situation are observed. Used to enhance metacognition explicitly, they can contribute, by default, and to stimulate self-discovery, self-esteem, self-evaluation of students.

### **9. Presentation and interpretation of results**

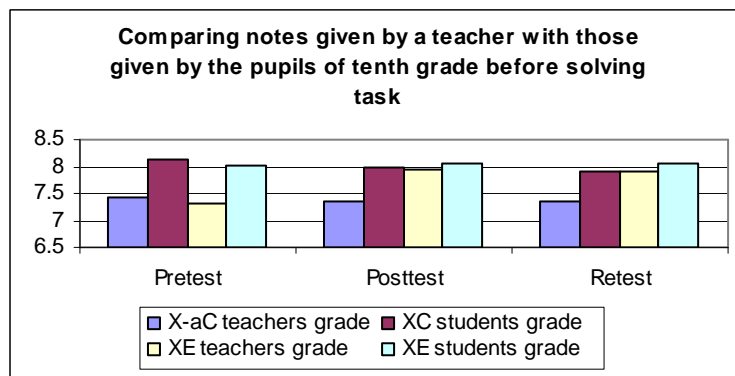
Starting from the premise that students' metacognitive capacity building can lead to a more objective self-assessment of the students, students have been given a knowledge test, asking them to self-assess themselves before and after solving tasks. The results are presented, comparatively, on the three main stages of

research (pre-test, post-test, re-test) and two categories of groups (control and experimental), below:



**Chart. 1.** Comparing notes given by a teacher with those given by the students of ninth grade before solving task

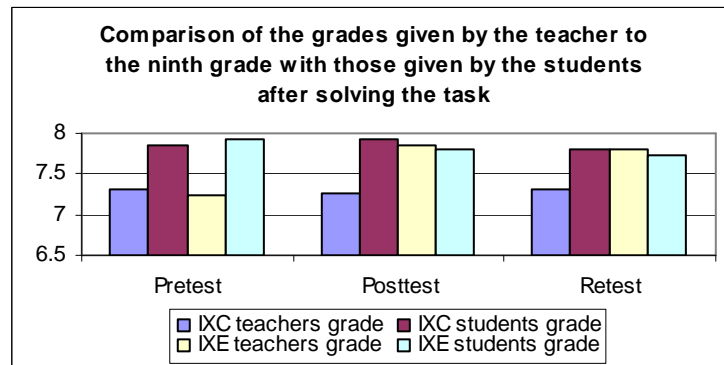
**Note:** IXC = control sample consists of classes IX  
 IXE = experimental sample consists of classes IX  
 XC = control sample consisting of classes X  
 XE = experimental sample consists of classes X



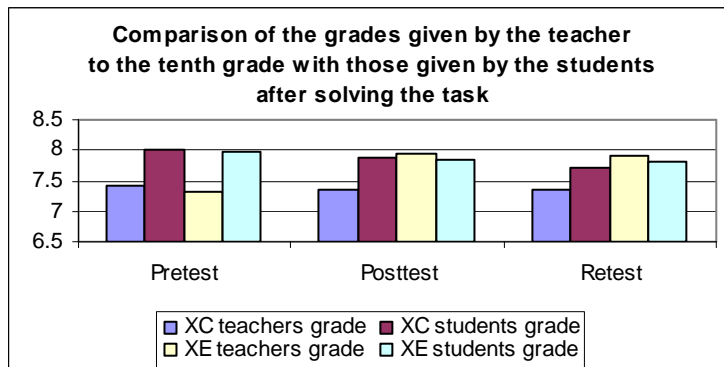
**Chart. 2.** Comparing notes given by a teacher with those given by the pupils of tenth grade before solving task

As it can be seen from the data presented, the difference between the marks given by the teacher and the students themselves, obviously reduced at the experimental classes in the posttest and retest stages compared with the pretest, while the control classes the difference remained between the same limits in the

three stages of research. We can also notice that, in case of the experimental classes, the small difference recorded between the teacher and the student's marks indicate, however, an over - appreciation of the students when it precedes the confrontation with the school task proposed.



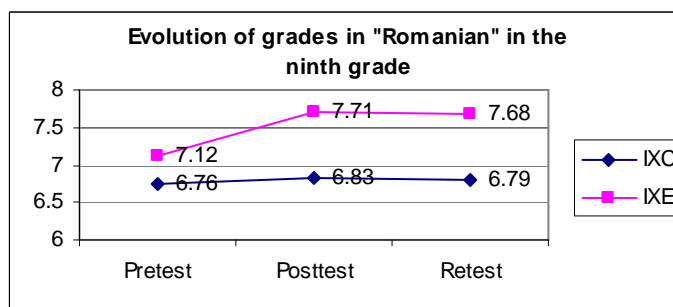
**Chart. 3.** Comparing notes given by a professor with those given by the pupils of ninth grade before solving task



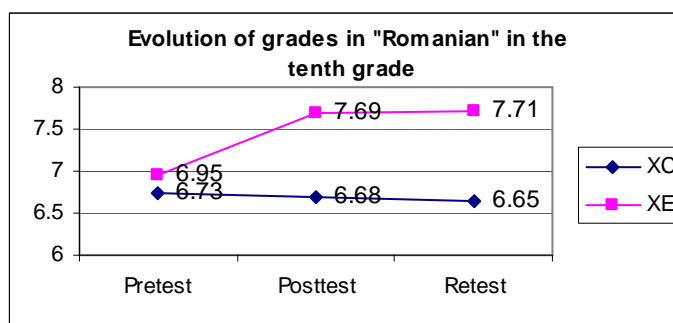
**Chart. 4.** Comparing notes given by a teacher with those given by the students of tenth grade, after solving the task

The data presented in graphs 3 and 4 show that, as is the case of even self-evaluation of performance, experimental students have made tangible progress, while for the control classes, the students self evaluative opportunities did not undergo great changes. The progress reported in the experimental group is due to the formative interference performed on this training, whose lines of action were presented in the previous chapter. Development of self-assessment (Stan, 2000, 2001) of the students performance in experimental classes is a consequence of improvements in self-discovery, and meta-cognitive capacities, which allow self monitoring and cognitive self-regulation of the route taken.

The formation of self-assessment of students' competence was reflected in obtaining better results in the subject "Romanian language and Literature, a point highlighted by the average recorded in this subject.



**Chart. 5.** The average change in "Romanian", in the ninth grade



**Chart. 6.** The average change in "Romanian", in the tenth grade

The progress of the students belonging to the experimental classes can be better emphasized by means of statistics calculating formulae. In order to do this we used test Z for large groups based on the following:

$$z = \frac{|x_1 + x_2|}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

With the ninth graders in the pretest stage the value of Z was 1.45 meaning that, in this case, the difference between the two groups was irrelevant statistically speaking. The next thing we have to do is to calculate the values of Z for the other two stages (post-test and re-test) in order to check if the results confirm the effectiveness of the experiment applied to the group of the ninth graders. The value obtained is  $Z=5.27$  which is statistically relevant by an accepted level of significance of 0.01.

The following procedure is to draw a comparison between the two groups of ninth graders (the experimental and the control group) based on the results from the re-test stage in order to see the stability and validity of the acquisitions and check the progress from the post-test stage. The value we obtained for  $Z$  is 4.36 which is statistically relevant by the same accepted level of significance.

With the tenth graders in the pre-test stage the situation is similar: the difference between the experimental and the control group is statistically irrelevant ( $Z=0.71$ ). The value of  $Z$  obtained as the result of comparing the experimental group with the control group in the post-test was 3.64 which is statistically relevant.

The same calculating method was used for the results obtained in the re-test stage. The value of  $Z$  was 3.64 which is statistically relevant by the same accepted level of significance 0.01.

The data presented by this research confirm the general assumption of our work. Taking into account the biunivocal relation between metacognition and self-assessment which we tried to demonstrate, we consider that a very effective method to use is the development of the students' metacognitive abilities if we want to achieve an objective self-assessment of the student, an assessment which can reflect the relation between the expectations and the students' achievements and the relation between the information the student has about his achievements and the information the teacher offers him. Due to this metacognitive abilities the students possess they can become aware of the cognitive processes they resort to as well as the measures they take in order to solve the task within the teaching-learning stage. They can also identify the errors very easily but they are also able to notice the good aspects of their work and, thus they can improve their learning using all the information and learning more efficiently. In order to do this, all the teachers must be constantly interested in creating a favourable educational frame system.

## **10. Conclusions**

The development of the self-assessment/self-evaluation competence constitutes an essential purpose of the educational system nowadays if we take into account the importance it bears for the students' activity in school and for the success of their activity. The metacognitive abilities play an essential role in the process of forming this competence. This process is very complex and therefore, it requires the involvement of all the teachers who must take care of creating a good motivation for the students and make them act or react in properly designed situations. Thus the main courses of action used in our experiment and proven effective can be largely applied to other subjects of the educational syllabus. We feel we should put an emphasis on the necessity of collaboration: all the teachers of a class and the form-master must work together in order to know their students better and to concentrate their efforts on making them know themselves better so that they can perform better in class.

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