Profiles of metacognitive reflection in future teacher university students

Adina-Elena Glava⁹, Cătălin-Cosmin Glava¹⁰ *

⁹ Babeș-Bolyai University, Faculty of Psychology and Sciences of Education, 7 Sindicatelor street, 400029, Cluj-Napoca, Romania
¹⁰ Babeș-Bolyai University, Faculty of Psychology and Sciences of Education, 7 Sindicatelor street, 400029, Cluj-Napoca, Romania

Abstract
We explored the commonalities in future teachers’ metacognitive reflection and defined a set of statistically proved metacognitive reflection profiles at this type of students. The study developed within an experimental approach, allowed us to define four consistent profiles of metacognitive reflection, each illustrated by specific behaviours that reflect a type and degree of metacognitive awareness, knowledge, control and regulation of own learning. Data reflects the most important components of a task that learners refer to when metacognitively regulate their learning. Through the focuses of the profiles, they offer central points for the design of future systematic metacognitive training of students.

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1. Theoretical background and purpose of study

Metacognition represents the articulated and flexible system of knowledge that the subject has regarding her own cognitive system characteristics and functionality and her capacity of using this knowledge for his optimal cognitive functioning.

The effective metacognitive training is associated in the recent field literature with the construction of a constructivist learning environment [1, 3, 4]. In the approaches that include the implicit metacognitive training as well as in the ones that involve explicit development of metacognition the characteristic of constructivist learning are often obvious: students activism, reflective attitude, integration of students in cooperative learning contexts, acceptance of alternative approaches and solutions, exercising of questioning and self-questioning, construction, de-construction and re-construction of knowledge.

We considered different methodological contexts that have the potential of promoting the metacognitive involvement and development of the learners. Finally, we opted for the following methodological instruments: the project method and reflection, considered here as a specific method of cognitive processes (self) analysis. In the stage of designing the experimental approaches, in order to identify functional means for metacognitive training usable in university settings, we created an original methodological context that integrates two major perspectives from which, in our opinion, the metacognitive training may be approached:

• facilitating the activation and manifestation of metacognition in learning situations
• metacognitive facilitation of learning

* Catalin-Cosmin Glava. Tel.: +4-0745-141157; fax: +4-0264-590559
E-mail address: catalinglava@yahoo.com

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The central element of our research was represented by the metacognitive reflection. We started form the premises that creating moments of systematic reflection on the cognitive actions carried on for accomplishing a learning task has the potential of activating and supporting efficient use of metacognition and metacognitive regulation.

2. Method

One of the premises that represented the base of our experimental design was that exposing students at cognitive complex activities implies active metacognitive control and regulation in order to support and develop these activities. In our case, we opted for project based learning as a methodological context that took the form of cooperative investigation project and for reflection as the main means for assuring the metacognitive awareness and control over learning.

The general hypothesis of the study was the following: Consistent application of an integrated educational program, that values reflection as a principle of learning, project work as a methodological context and cooperation as a relational climate, offers a favorable environment for students’ metacognitive behavior development and contributes significantly to improving efficiency of learning through metacognitive facilitation.

Formative intervention program was introduced for a period of 14 weeks and it involved a number of 124 future teacher university students. It was proposed during the seminar activities of three important courses selected for the experiment. The program included the 28 hours of seminar activities for each of the three disciplines involved in the study and also important individual and group study periods initiated by the students in the periods between the seminar meetings.

The general image of the programme consists of three important parts of the intervention:
Part I: Introduction of the study manner and presentation of the working guide (2 hours)
Part II: Development of the three project based learning sessions with specific actions for each session (24 hours, see figure 1)
Part III: Finalization of the programme and feedback (2 hours)

The experimental protocol included three main sessions of projects, with identical structure. They articulated between them according to the model: action – reflection- action.

Figure 1 presents in a visual manner the three project session organized and the investigation instruments used during the intervention:

As it is visible in the above scheme, the independent variables are present both in the period of project sessions, when subjects were involved in solving cooperative project based tasks and reflected on the approaches and learning processes they developed during these projects, by using open metacognitive reflection electronic diaries created through blogging facilities, and between the project sessions, when students presented their learning approaches and products of projects and filled other more structured metacognitive reflection instruments: structured reflection electronic diary and progress sheet. During each project session, subjects opted to involve in a project task. They were grouped in cooperative groups of 5-7 participants and after they opted for the groups, they were invited to preserve this organization during the whole period of intervention. They were asked to assume a total of three project based learning tasks and to initiate individual and cooperative articulated actions for solving the project tasks. The formulated tasks were correlated with the themes followed in the course period. Each project task was studied for a period of four weeks. During this period of cooperative project work, students were invited to
metacognitively reflect on the work done at the beginning, in the middle and at the end of the study period. This experimental session was re-initiated two times more with a new project task in the next period of the intervention.

Considering the risk of overloading the students with the extra tasks related to completed the reflection and evaluation instruments, we insured that the items integrated in these instruments are logic and easy to understand and that the instructions are clear and motivation.

3. Results and discussions

We opted for both quantitative and qualitative measurements and discussions, and for both intra groups and intergroups analyses. The research was complex and offered us valuable data regarding the metacognitive behaviours and reflections of future teacher students. On the other hand, the intragroup analyses offered us the possibility to identify detailed correlations, to develop refined qualitative comments that offered a complete image of the evolution of the experimental groups during the formative intervention.

For the intrasubjects analyses we have chosen to present the data collected through the exploration of each of the data collection instruments used: (open) reflection electronic diary, structured electronic diary, progress sheet. We also analysed in a detailed manner the way students involved in development of the projects and the results, products of the projects, developing correlation measurements with the reflection data gathered during the project work. In the present paper we will present the results of the qualitative analysis of the metacognitive reflections included in the open diaries, as well as the analysis of their dynamics during the experimental intervention.

The observations conducted us to the conclusion that a set of patterns in the metacognitive reflection that future teacher students undertake. Shortly, we intended to explore the possibility of defining certain metacognitive reflection profiles/models. By these models we understand consistent reflection behaviour oriented towards a certain set of variables. In order to approach this line of research we have undertaken a factor analysis process, taking as the reference point the behaviours included in the reflection diaries quantitative evaluation inventory. The facility of standard exploratory factor analysis existing in the SPSS Pack allowed us to visualize the manner in which the features that refer to similar aspects, included in the evaluation inventory group according to the intensity they have in description of each of the identified factors.

Six factors were identified to have the Eigenvalue quotient higher then 1.00. Their signification was processed according to the content of the variables that influenced them the most. The octagonal factor rotation determined the factorial structure presented in table 1.

During data processing we focused on the variables that explain in more detail the factors identified by SPSS and we decided to extract four factors that are relevant for our study objective: identification of a set of metacognitive reflection models for future teacher students.


<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in results description</td>
<td>.748</td>
</tr>
<tr>
<td>Awareness about the difficulties in following the planning</td>
<td>.655</td>
</tr>
<tr>
<td>Degree of evaluation about task difficulty</td>
<td>.475</td>
</tr>
<tr>
<td>Degree of awareness about previous experiences</td>
<td>-.013</td>
</tr>
<tr>
<td>Expressing the degree of satisfaction about the success of the project</td>
<td>.170 .574 -.085 .234 .068 .091</td>
</tr>
<tr>
<td>Evaluation of self-efficacy</td>
<td>.149 .515 .201 .276 .394 .241</td>
</tr>
<tr>
<td>Awareness about the sources of success and failure</td>
<td>-.076 .200 .783 -.114 .114 .285</td>
</tr>
<tr>
<td>Evaluation of the quality of group work</td>
<td>.026 .389 -.645 -.011 .151 .204</td>
</tr>
<tr>
<td>Monitoring the distance to the preset objective</td>
<td>.082 .019 .044 .730 -.129 .226</td>
</tr>
<tr>
<td>Degree of objective awareness</td>
<td>.005 .030 -.061 .621 -.278 .366</td>
</tr>
<tr>
<td>Considering in detail the alternatives in task solving</td>
<td>.112 .034 .010 .017 .863 -.040</td>
</tr>
<tr>
<td>Accuracy of planning</td>
<td>.041 -.064 .073 -.042 -.008 .844</td>
</tr>
</tbody>
</table>
Thus, the factor 1 we associated with the Profile of Metacognitive Reflection Focused on the Task. The components associated with this profile are the following:
- The accurate awareness about the difficulties in following the preset work and learning plan;
- Capability of accurate appreciation of difficulty of the learning task;
- Capacity of accurate description of the results and of the quality of the learning activity undertaken.

In more detail, the profile of metacognitive reflection focused on the learning task is characterized by a pragmatic approach of the learning task requirements and an orientation of the cognitive resources for task solving. The subjects that are included to this profile declare their availability for making adaptations to their own learning process during the whole period of task solving, according to the specific context that appear, in order to bring the task to an end. Their high capacity of accurately describing the quality of own learning activity and of the difficulties encountered, as well as of the results obtained, represents a characteristic that stresses the pragmatic orientation of this metacognitive reflection profile.

The factor 2 was associated with The Profile of Self-centered Metacognitive Reflection, a model described by the following components:
- Degree of awareness about the previous learning experience;
- Capacity of accurate evaluation of personal efficacy in project based learning tasks;
- Depth of the statements related to personal satisfaction about the success of the project.

The representatives of this profile use in their metacognitive reflection reference points related to planning, metacognitive monitoring and regulation related to own person (ex.: satisfaction related to the results of learning, previous experience, knowledge regarding own cognitive functioning etc.). Tendency in these subjects is to attribute the success or the failure in task solving to the personal factors and often, to avoid their own involvement into the cooperative work.

Factor 3 was named The Profile of Heterocentered Metacognitive Reflection, a profile that integrates the following characteristics:
- Capacity of becoming aware of the sources of own success or failure in developing of the learning task;
- Accuracy and depth of evaluation of group work.

The main characteristic of this profile is focusing on the contextual learning situation factors while reflecting metacognitively: colleagues, work atmosphere, quality of cooperation learning and work, evaluation of impact of this factor on the quality of own learning. The reflections regarding the cooperation activity, the specific and the consequences of it for the quality of learning approaches are frequent and solid in the case of this profile.

Factor 4 was described as being the Profile of Metacognitive Reflection Focused on the Goals, a model that is described by the features presented below:
- Degree of awareness on the objectives associated with the learning tasks;
- The accuracy of monitoring the distance to the reaching of the objectives associated with the learning task.

The key element which the reflections in this model are focused on are the evaluation criteria, work and learning plan, rules and instructions the come with the learning task. The learning approach in the case of this profile is guided by the reference points offered by these exterior components that are often given in advance by the teacher through the learning goals.

Even though the last two factors in the factor analysis grid are not clearly defined, the quantitative analysis of the variables describing those factors suggested us a possible grouping of them into a complementary profile that of the metacognitive reflection focused on planning. Yet, as this profile integrates variables that represent small variance percentages, we did not consider this last profile as being as accurate as the previously described profiles.

Use of metacognitive reflection and involvement of students in complex, ill structured learning situations, articulated into a well structured educational programme proved efficient for the activation and supporting of the metacognitive regulation behaviours, and consequently, for optimization of learning through metacognitive facilitation. Within the larger experiment designed and developed by us, the identification of the metacognitive reflection profiles was relevant as such models order the large and varied amount of data and ideas related to declaration of learners. Moreover, the fact that the student we observed where future teacher students gives, in our opinion an increased significance and value to the data obtained. Thus, the profiles identified highlight the most important components of a learning task that become reference points for the students involved in solving an ill
structured project based cooperative learning task: objectives, own process of learning, relationship with colleagues, outcomes. Moreover, through the focuses of the profiles, it offers central points for the design of future systematic metacognitive training of students. Even though we incline to consider that the most effective training in metacognition is an integrated programme, we can anticipate that an explicit training programme that consider that training the students in formulation of objectives, planning of cooperative work, planning of learning based on evaluation criteria, management of own learning and feelings can be a successful one.

The metacognitive development programme based on reflection and cooperative project work had significant positive effects in other components too. Thus, the qualitative and quantitative data gathered from reflection diaries prove that the project work was considered useful for its challenges related to cooperative learning. An important number of subjects considered cooperation as a good exercise for personal views articulation, an aspect that requires further studies, given its metacognitive implications. Reciprocal rationales debate and communication, as well as the creation of group cohesiveness were also considered useful exercises within the context of cooperation. Along the three project sessions the opinions of students regarding cooperation evolved, the rate of success attribution to these factors increasing. The increase in the incidence of situations when subjects were interested in understanding the source if their success or failure in learning was also proved, this last fact being, in our understanding, an important indicator of presence of consistent reflection on students’ own learning processes.

4. Conclusions

Metacognitive reflection proved to be an extremely efficient mobile for the organization and supporting of metacognitive training. Field literature indicates three main sources of metacognitive development within the formal educational programmes: a. Direct involvement of students in explicit training situations centered on metacognitive development: modelling, guided practice, independent learning; b. cooperative learning: developing self-efficacy, selecting strategies, becoming aware of self conditional knowledge, learning self regulation and c. autonomous learning, in the case of involving students in complex learning situations that requires construction and validation of knowledge and strategies.

Metacognitive education of learner is part of the contemporary issues in formal educational programmes, and it is integrated in the larger objective of assuring the effective learning and information processing, developing the cognitive system and critical and creative abilities of students. A total number of 376 diary complex entries were studied. The exploratory standard factor analysis study developed conducted to identification of clusters of indicators for a specific orientation towards certain types of metacognitive reflection. The study allowed us to define four consistent profiles of metacognitive reflection, each of them illustrated by specific metacognitive behaviors that reflect a certain type and degree of metacognitive awareness, knowledge, control and regulation of own learning. Considering the fact that the study reflects the metacognitive behaviour of future teachers, the relevance of data obtained is double. On one hand, it reflects the most important components of a learning task that learners refer to when metacognitively control and regulate their learning. On the other hand, through the focuses of the profiles, it offers central points for the design of future systematic metacognitive training of students.

References