

STUDY ON METACOGNITIVE METHODS AND TECHNIQUES USED BY THE STUDENTS OF THE LAND FORCES ACADEMY FROM SIBIU

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Abstract: *In this study we aimed to identify the main metacognitive skills that military students have developed as a result of their involvement in the academic and training activities carried out in the academy. For this we built a questionnaire consisting of 46 items divided into two major dimensions of metacognition. Data obtained from the questionnaire were subjected to factor analysis that resulted in detaining thirteen factors representing categories of metacognitive methods, techniques and strategies used by the students of the Land Forces Academy from Sibiu.*

Keywords: *metacognition, factorial analysis, military students*

Introduction

The concept of metacognition was introduced by Flavell and his colleagues in the 70s. The concern for this issue begins with studies on child development, of knowledge about their memory (metamemory), understanding (metacomprehension) and communication (metacommunication). Later, the research area widens and studies about the metacognition appear, which Flavell defines as "knowledge and cognition about cognitive phenomena" (apud Coutinho, 2006, 162).

Schraw and Moshman (1995) indicate that in the literature there is a fundamental distinction between *metacognitive knowledge* (the individual knowledge about his own self) and *metacognitive control processes* (processes used by the individual to regulate his own knowledge).

The components of *metacognitive knowledge* are as follows (Tarricone, 2011, 194-195):

1. Declarative Metacognitive Knowledge (knowing about knowing) includes:

1.1. *Knowledge of self and others (Person)*

1.1.1. Knowledge of intra-individual (knowledge of self, knowledge of self-system, knowledge of metacognitive reflection, knowledge and beliefs about one's motivation)

1.1.2. Knowledge of inter-individual

1.1.3. Knowledge of universals of cognition (universal properties of human beings)

Knowledge of self includes the knowledge of the personal attributes (including memory), capabilities, characteristics, abilities, strengths and weaknesses, self-knowledge, self-awareness, self-discovery, self-understanding, beliefs about self-knowledge, about memory ability, capability and effectiveness etc.

Knowledge of self-system includes self-esteem, attributional beliefs, emotions, self-efficacy (including memory self-efficacy), self-concept, self-appraisal or self-reflection, self-beliefs etc.

1.2. *Knowledge of task and context* (including Sensitivity) (Task)

1.2.1. Knowledge of task demands (including Sensitivity) (knowledge of task demands, sensitivity to task demands, knowledge of beliefs about task or situations)

1.2.2. Knowledge of task information

1.2.3. Knowledge of cognitive goals (task objectives)

1.3. *Knowledge of strategy* (Strategy)

1.3.1. Knowledge of strategy attributes

1.3.2. Knowledge of strategy (influenced by person and task variables)

1.3.3. Knowledge of strategy (influenced by task demands and context)

1.3.4. Knowledge of strategy (facilitated by and influences monitoring and control)

2. ***Procedural Metacognitive Knowledge*** includes:

2.1. *Knowledge of self and others* (Person)

2.1.1. Knowledge of intra-individual (self-knowledge and self-system)

2.2. *Knowledge of task and context* (including Sensitivity) (Task)

2.2.1. Knowledge of task objectives (cognitive goals and subgoals)

2.2.2. Knowledge of task complexity (demands) (influenced by person and strategy)

2.2.3. Knowledge of task content

2.3. *Knowledge of strategy* (sensitivity to strategy application and initiation)

2.3.1. Knowledge of strategy application and initiation (Sensitivity)

2.3.2. Knowledge of strategy appropriateness

2.3.3. Knowledge of strategy transferability and adaptation

3. ***Conditional Metacognitive Knowledge*** (knowing when, where and why) includes:

3.1. *Knowledge of self and others* (Person):

3.1.1. Knowledge of intra-individual (self-knowledge and self-system)

3.2. *Knowledge of task and context* (conditional – when and contextual - Sensitivity tot Task)

3.2.1. Knowledge of task demands

3.2.2. Knowledge of task tipe and context

3.3. *Knowledge of strategy* (sensitivity to strategy initiation)

3.3.1. Knowledge of strategy application and initiation (Sensitivity)

3.3.2. Knowledge of strategy appropriateness

3.3.3. Knowledge of strategy transferability and adaptation

Schraw and Moshman (1995) show that the way individuals structure their knowledge about cognition in general and especially about their own cognition was very little studied by researchers in the field. These authors consider that „individuals construct metacognitive theories for two reasons: (a) to systematize their metacognitive knowledge, and (b) to understand and plan their own cognitive activities within a formalized framework.” (Schraw și Moshman,1995, 352). Metacognitive theories integrates individual beliefs and postulates on which he will succeed „to predict,

control, and explain their cognition, the cognition of others, or cognition in general” (Schraw și Moshman, 1995, 357)

Metacognitive knowledge bases are made in early childhood and develop throughout adolescence. Skilled learners often show a high level of development of declarative, procedural and conditional metacognitive knowledge.

The category named by Tarricone „Regulation of cognitions or Metacognitive Skills and Executive Functioning” includes the following elements (Tarricone, 2011, 196):

1. Regulation of cognitions and Executive Functioning

1.1. Monitoring and Control (includes executive functioning and metacognitive skills)

1.1.1. Regulation of person knowledge (intra-person monitoring and control, inter-person monitoring and control, intra- and inter-reflection and reasoning)

1.1.2. Regulation of task knowledge

1.1.3. Regulation of strategy knowledge (monitoring and control of strategies)

1.2. *Self-regulation*

1.2.1. Regulation of intra-individual (person knowledge –self knowledge and system-knowledge)

1.2.2. Regulation of task knowledge (task objectives, task demands)

1.2.3. Regulation of strategy knowledge (strategy applicability, regulation and transfer)

2. Metacognitive Experiences

2.1. *Metacognitive Feelings* (of person, of task and of strategy)

2.2. *Metacognitive Judgements* (of person, of task and of strategy)

Metacognitive feelings are not the same as emotions or affect. Metacognitive feelings of person include feelings of confidence and feeling of satisfaction. Metacognitive feelings of task involve awareness of the connection or the disparity between task goals and outcome and include: feeling of familiarity, feeling of difficulty, feeling of satisfaction. Feeling and knowing phenomena influence strategy selection and application.

Metacognitive judgments of person include estimate of learning/feeling of knowing judgments. Metacognitive judgments of task include estimate of solution correctness and metacognitive judgments of task include estimate of effort expenditure.

Regulatory competence improves the individual’s performance both in learning and problem solving, facilitating a better use of cognitive resources and learning strategies. It also increases the individual consciousness on failure or success as well as metacognitive experiences. Monitoring and control improve performance in memory tasks and in thinking.

The two components of metacognition - *metacognitive knowledge* și *regulatory proceses* are interdependent.

Methodology

In this study we aimed to identify the main metacognitive skills that military students use in the academic and military training activities. For this purpose we constructed a questionnaire consisting of 46 items divided into two major dimensions

of metacognition - *metacognitive knowledge (declarative, procedural and conditional) și metacognitive regulatory proceses (monitoring, control and evaluation)*.

Students were asked to evaluate to what extent a series of statements about the use of methods, techniques and metacognitive strategies in academic and military training activities are true, in what they are concerned. A Likert tipe scale was used, with values from 1 to 5, where 1 means "very little" and 5 means "very much".

The questionnaire was applied to a total of 200 students from years of study II and III, from the Land Forces Academy in Sibiu, in October-December 2013. Within this sample there were summarized 48 (24%) girls and 152 men (76%), aged 20 to 23 years old, meaning an average age of 21.27 (s.d. = 3.34). The questionnaire was anonymous.

The statistical tests indicated that the structure of the questionnaire is suitable for factorial analysis (KMO = 0.692., Bartlett's Test of Sphericity: $p < .001$). The result is shown in Table 1. Our data is suitable for factor analysis.

For factor analysis we used Principal Axis Factor (PAF) and we rotated the matrix of loadings to obtain orthogonal (independent) factors (Varimax rotation with Kaiser Normalization). The prime goal of factor analysis is to identify simple items loadings (>0.30) on factors that are interpretable, assuming that items are factorable.

For all procedures reported here we utilised SPSS 16.0.

Table no.1.KMO and Bartlett's Test Criterion

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,746
Bartlett's Test of Sphericity	Approx. Chi-Square	5,163E
	df	1035
	Sig.	,000

Results

The factor analysis procedure identified 10 factors. At this level of analysis, statements with factor loading less than 0.4 and those that load several factors simultaneously were considered inappropriate. The results are shown in Tables 2, 3 and 4. The data was divided into three tables because of restrictions imposed by the terms of editing.

Table no. 2. Factorial Structure - Rotated Factor Matrix (Factors 1 - 4)

Item	Factors				Communality
	1	2	3	4	
Studying in a systematic way	,835				,808
Working in a systematic way	,757				,718
Evidence of objectives to be achieved during the task	,505				,572
Determined effort in homework/work/ portfolios	,401				,473

Checking the depth of the study		,681			,703
Monitoring the progress during the study		,677			,712
Monitoring the understanding of the subject being studied		,656			,675
Effort for intellectual development through learning			,647		,681
Correlation of learning tasks with personal goals			,516		,571
Setting personal goals related to learning			,471		,380
Identification of resources required for achieving success in learning			,464		,610
Final verification of the understanding of the studied items				,664	,651
Change of inefficient strategies				,628	,535
Verification of the understanding of the tasks				,515	,671
Identification of interesting items from the compulsory topics				,431	,512
Eigenvalue	12,183	2,673	2,227	1,991	
Percentage of total variance	26,485	5,811	4,840	4,329	

Table no. 3. Factorial Structure - Rotated Factor Matrix (Factors 5 - 8)

Item	Factors				Communality
	5	6	7	8	
The habit to learn from other people's experiences	,690				,836
The habit of inspiring from the methods of study and work of successful people	,659				,622
The habit of finding ideas in discussions about other people's learning methods	,539				,550
The use of self-suggestion to solve the tasks that seem pointless		,591			,510
Identifying the causes of aversion towards some tasks		,543			,597
The habit to awaken positive emotions toward the tasks		,487			,566
Cooperation with others to solve work tasks			,667		,691
The belief that it is important to learn			,518		,678

while they are in school					
Cooperation with others in learning tasks			,443		,555
The habit of identifying what they have learned from those with they work or learn			,412		,501
Optimal use of time				,636	,559
Optimal dosage of effort				,609	,702
Eigenvalue	1,883	1,713	1,668	1,471	
Percentage of total variance	4,093	3,724	3,626	3,199	

Table no. 4. Factorial Structure - Rotated Factor Matrix (Factors 9 - 13)

Item	Factors					Communality
	9	10	11	12	13	
Knowledge of methods to increase the involvement in the study	,706					,604
The habit of reviewing the benefits derived from studies carried out up to a certain point	,496					,511
The habit to treat seriously all parts of a task	,444					,740
Clearing bottlenecks which occurred in the collaboration with colleagues		,706				,669
Using feed-back given by instructors and teachers on various working methods		,423				,615
The habit to reward themselves for success			,680			,648
Identifying those factors that increase personal effectiveness in learning			,427			,487
Obtaining an accurate image of their own intellectual abilities				,630		,579
Assessment of individual work efficiency compared to that of solving through cooperation with others, before starting the task				-,464		,634
Control of negative emotions				,454		,544

in learning or solving tasks						
Identification of irrelevant information in a learning or working task					,602	,428
Identification of valuable elements in a learning or working task					,450	,471
Eigenvalue	1,387	1,289	1,199	1,174	1,098	
Percentage of total variance	3,016	2,803	2,606	2,552	2,388	

The first factor is loaded with items that relate to the students' habit of working and studying systematically, to keep track of goals they are going to achieve while working on a task and to maintain a sustained effort to solve a homework/paper/portfolio. We called this factor "systematization of activities." This factor explains 12,183% of the total variance.

The second factor is charged with three items referring to the verification of the study depth (avoidance of the superficial), monitoring the progress during the study, verification of subject understanding. We called this factor "study efficiency". This factor explains 2.673% of the total variance.

The third factor consists of four items referring to: the students' conscious effort to develop intellectually by learning, to correlate workload goals with personal goals, to establish personal goals related to studio, other than those imposed by teachers and identify the resources needed to be successful in what they study. We called this factor "intellectual development through study". This factor explains 2,227% of the total variance.

The fourth factor is loaded with four items: verifying the understanding of the studied material and of the tasks to be solved, changing ineffective work or study strategies, identification of interesting elements from materials received for compulsory study. We called this factor "Checking understanding." This factor explains 1,991% of the total variance.

The fifth factor is loaded with the following items: the habit of learning from other people's experiences as well as from the talks about their study methods, inspiring oneself from the methods of study and work of successful people. I called this factor "indirect learning." This factor explains 1,883% of the total variance.

The sixth factor is loaded with items that relate to the students' use of self-suggestion to solve tasks that seem pointless, to the identification of aversion causes when faced with some workloads and to the habit of awakening positive emotions when they have something to study or solve a task. We called this factor "Managing cognitions and emotions." This factor explains 1,713% of the total variance.

The seventh factor is composed of items that relate to the practice of students to cooperate with others when they have done a load of work or when studying, to identify what they have learned from those with whom they work or study and to their belief that it is necessary to study while they are in school. We called this factor "cooperation in study and work". This factor explains 1,668% of the total variance.

The eighth factor is loaded with two items that are related to the efficient use of time and the optimal dosage of effort to face a working or learning task easier. We called this factor “optimal dosage of time and effort”. This factor explains 1,471% of the total variance.

The ninth factor is loaded with three items that relate to: the knowledge of methods to increase the involvement in study, the habit to treat seriously all parts of a task and to review all benefits derived from studies made up to a certain point. We called this factor "Auto-adjusting the level of involvement in the task." This factor explains 1,387% of the total variance.

The tenth factor is loaded with two items related to students' solving of bottlenecks in cooperation with their colleagues and the use of the trainers' and teachers' feed-back on their working methods. We called this factor "Managing relations during the task". This factor explains 1,289% of the total variance.

The eleventh factor is loaded also with two items that refer to the students' practice to reward themselves for their own success and the identification of those factors that increase personal efficiency in studying. This factor was named "Managing personal effectiveness". This factor explains 1,199% of the total variance.

The twelfth factor contains the following items: obtaining an accurate image of their own intellectual capacities, the control of negative emotions while studying or solving a task, the evaluation, before solving a task, of individual work efficiency compared to that of solving through cooperation with others. This factor was called "Accurate picture of their own abilities". This factor explains 1,174% of the total variance.

The thirteenth factor is loaded with two items that relate to the identification of irrelevant information as well as of valuable elements of a task or work study. We called this factor “Simplifying tasks”. This factor explains 1,098% of the total variance.

Conclusions

In the university system, teachers expect students to come up with a high level of metacognitive development. Throughout the previous school years, metacognitive skills have been developed and practiced; along the university years, the student must bring them to a higher level and to work on deficient issues.

Although it is recognized that age and experience have an obvious influence on metacognitive skills acquired by individual learners, however, metacognition must be explicitly taught and learned. Metacognitive skills development must start early in training and the educational system should aim for the highest levels of intellectual training. The ultimate goal of teaching metacognitive strategies is the students' acquisition of cognitive autonomy.

After analyzing the data obtained by our study, we noted thirteen factors that represent potential categories of metacognitive methods, techniques and strategies used by students from the Land Forces Academy of Sibiu. Therefore, we concluded that they use to work and study in a systematic way, using methods to streamline the study, to check understanding of what they studied, to simplify tasks, to manage cognitions and emotions, to cooperate in the study and activity, to calibrate the optimal

effort and time resources, to regulate the level of involvement in the task and manage personal effectiveness and relationships during the task. All these are part of the regulatory processes of metacognition.

Regarding metacognitive knowledge, students work in order to develop intellectually through study and to form an accurate picture of their intellectual capacities and resolutions.

Military students are mostly young people going just out of adolescence, so they enter the military system with varying degrees of maturity. If the student is a graduate of a military high school, we can count on the fact that he has a higher level of maturity than his age, due to the specific training and living conditions in this type of school. In any of these situations, the students' cognitive and psychosocial development is not over and that is why the university, through its teachers must cultivate and develop students' awareness about their cognitive abilities and their successful use.

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