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PSYCHOLOGICAL FACTORS OF COGNITIVE LEARNING STRATEGIES FORMATION IN STUDENTS

The article is devoted to the study of psychological factors underlying the formation of cognitive learning strategies. The concept 'cognitive learning strategies' and their types is explained, the definitions 'cognitive styles', 'learning styles', 'metacognition' were analyzed. The results identify that the psychological characteristics responsible for the formation of cognitive learning strategies are, on the one hand, an 'orientation towards time', a 'need for cognition' and 'autonomy' (the factor of 'constructing your personal space'), and, on the other hand, self-reflection, high normativity of behavior and self-control (the 'regulative' factor). Refs 21. Tables 2.

Keywords: learning strategies, cognitive strategies, educational activities, psychological factors.

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ПСИХОЛОГИЧЕСКИЕ ФАКТОРЫ ФОРМИРОВАНИЯ КОГНИТИВНЫХ УЧЕБНЫХ СТРАТЕГИЙ У СТУДЕНТОВ

Статья посвящена изучению психологических факторов, лежащих в основе формирования когнитивных учебных стратегий. Раскрыто понятие когнитивных учебных стратегий и их видов, проведен анализ близкого по содержанию терминологического ряда — когнитивный стиль, стиль учения, метапознание. Эмпирически установлено, что психологическими характеристиками, обуславливающими высокий уровень сформированности когнитивных учебных стратегий выступают, с одной стороны, показатели «ориентация на время», «потребность в познании» и «автономность» — фактор «конструирования своего личного пространства», а с другой — рефлексия, высокая нормативность поведения и самоконтроль — «регулятивный» фактор. Библиогр. 21 назв. Табл. 2.

Ключевые слова: учебные стратегии, когнитивные стратегии, учебные действия, учебная деятельность, психологические особенности.

Introduction

Studying is the type of the activity which has its aims, structure and the means to achieve these aims [1]. When studying, the person is involved in the cognitive atmosphere, in the system of particular tasks and exercises; and when doing these, the person develops skills and gains knowledge that contribute to the maximally effective learning process. The central part of studying is educational activities. Accomplishing educational tasks in the course of studies systematically provides the opportunity to understand the

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* The study was supported by the Russian Foundation for Humanities, project No 14-06-00521.

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multiplicity and variety of educational activities, to choose the most appropriate one for a specific task and to become experienced students who are used to studies.

The contents and the components of educational activities are determined by general characteristics of the studies: their compulsory and voluntary character and efficacy. This is caused by the fact that performance of any kind of educational activities is aimed at achieving a particular result, which is often given in the form of an example or a model, and requires following a certain program, or an algorithm. It implies control of the quality of the obtained result, comparing it with the given rules and requires submitting your actions to the conditions of the learning situation and controlling your behavior. Making the system of educational tasks more complicated leads to the extension and deepening of the complex of educational activities which are necessary to perform in order to accomplish these tasks. With time, involvement in studies makes the student perceive themselves as the author and the manager of their educational activity, or as the subject of their studies who is able to control information processing. Showing creativity in mastering the contents of the studied material can be considered an indicator of the person's becoming the subject of their studies, for example, practising techniques and approaches ensuring critical and effective learning, setting goals and tasks to complete the exercise, understanding the importance and personal pertinence of the performed educational activities, extending and acquiring additional knowledge and skills that are necessary for optimum organization of studies.

Problem Statement

The understanding of studies in the context of activity approach (S.L. Rubinstein, A.N. Leontiev, D.B. Elkonin, V.V. Davidov) dictates the strategy for creating the system of diagnostics for the process of studies: inspection of its components (educational activities and skills), as well as choosing and creation of a particular psychodiagnostic procedure to assess each component. Actually, this logic is the basis for constructing a set of psychometric tools to assess the level of development of the sphere of studies. The techniques have been created to diagnose the degree of formation of: a) prerequisites for studies for children aged 6–7 — “House” technique (the ability to follow the example); “D. Elkonin’s graphic dictation” technique (the ability to follow the rule); “Pattern” and “A string of beads” techniques (the ability to follow the system of requirements); and b) components of the sphere of studies for children aged 8–10 — “Carbon paper” technique (the ability to accept the educational task; “A. Zak’s logical problems” (the ability to plan their activities), “Grammatical B” (the ability to control their activities) [2]. However, practical experience shows that the formation of the subject of studies is not restricted by mastering its components (accepting the educational task, planning, controlling and assessing your activities). Their further development depends on the fact that different educational activities and algorithms form interrelationships and **fixed combinations (complexes of activities), which are activated automatically when doing different types of educational tasks.** Such complexes of educational tasks which are purposefully organized by the subject are referred to as **learning strategies** [3]. C. F. Weinstein and R. F. Mayer define learning strategies as the tools for information processing, implying the whole spectrum of cognitive activity that is involved in the process of studies and thinking [4].

The history of research strategies which students use in learning, associated with the development of behavior theory and cognitive approach in psychology. A significant

number of studies on cognitive strategies, including students, are J. Bruner's research [5]. L. Selinker suggested the term "communicative strategies" — the processes that are used during communication to compensate of shortage of linguistic resources [6]. There is the whole direction dedicated to the processes of formation of linguistic identity through the strategies. It includes the concepts makro strategies and universal strategies. Makro strategies are strategies to achieve and failure which are closely related to motivation of a person and reflect the specific of decision making on the starting of activity or its rejection. Metacognitive, social and affective strategies are universal kind of strategies [7].

Metacognitive strategies are the ability to focus, plan activity and evaluate the results. Affective strategies reduce anxiety and can be as a mean of self-stimulation. Social strategies include the ability and desire to ask questions, acquire information and cooperate [8].

Speaking about the learning strategies, we have to mention about metacognition. R. Sternberg defines metacognition as knowledge and representation concerning the process of cognition, the organization of cognitive processes which are involved in the learning process [9].

G. Schraw considers two aspects of metacognition:

- 1) Personal knowledge, which relate to the process of cognition.
- 2) The individual attempts to regulate or monitor cognitive activity.

G. Schraw describes metacognition as a multidimensional complex process regulated by learning strategies. In his opinion there is the relationship between academic performance and the presence of flexible repertoire of learning strategies in students [10]. These data are confirmed and spread in modern research. For instance, in studying the relationship between emotional intelligence and learning strategies. In the works of C. Ferrándiz and B. Shatalebi it was revealed that high emotional intelligence points to the increased use of learning strategies [11, 12]. In studies of the relationship between academic performance and learning strategies there were found differences in learning strategies of students with high and low academic achievements. Students with high academic achievement had increased repertoire of learning strategies [13].

The concept "learning strategies" is close to such definitions as metacognition, a cognitive style, thinking styles, and a learning style. Let us define the differences between them.

According to R. Sternberg, metacognition is the knowledge and ideas which are related to our cognition process, organization of our own cognitive processes involved in the cognition process [14]. There are two aspects of the cognition process:

1. personal knowledge related to the cognition process itself.
2. individual attempts to regulate and control cognitive activities.

A cognitive style is individually peculiar ways of information processing, which characterize the specificity of the person's mindset and the distinctive features of their intellectual behaviour. It is related to the process of the reflection of the reality in the individual consciousness in the form of a cognitive image (sensory, mental, etc.).

A learning style signifies individual differences in students' cognitive activity. These are individually peculiar ways of acquiring information in the course of studies [15].

Thus, we can see that the notions of a cognitive style, learning styles, as well as of a thinking style or metacognition are wider than the notion of learning strategies. All these notions are united by the common idea of answering the question about how to organize the process of your cognitive activity / studies effectively.

Learning strategies constitute the operational repertoire of an “experienced” student. Making it necessary for the person to choose particular actions from a variety of others, they characterize the navigational activity and the performance of the student for the following reason: although they mostly consist of habitual skills, including the formed ways to process the information, to assess, control and regulate students’ own activity, they still can change the habitual structure (to widen, to replace some operations and actions, to change their succession), while preserving the focus on the final goal. Thus, the structure of learning strategies is characterized by variability, multi-layered structure and hierarchy, because their component composition and form are determined not by the components of the studies, but by the content of educational work (the type of the task performed) that is to be done, by its complexity and intensity.

According to I. I. Ilyasov, all educational activities can be presented in the form of a two-level organization:

1st level — educational activities directed towards processing and acquiring information.

2nd level — organization and management of studies [16].

Correspondingly, in the course of their development, educational activities of the first level form different cognitive learning strategies, while educational activities of the second level — metacognitive ones. It is important to note that studies in higher education institutions significantly differ not only in content, but in functions as well. A specific system of educational tasks and exercises helps to gain knowledge and skills aimed at solving different types of professional problems, i.e. a certain range of professional competences. In this system, cognitive learning strategies are a psychological mechanism providing a synthesis of academic and vocational training. Characterizing the activity of students in the course of studies, they directly determine the technology of carrying out different types of class and individual work, which implies mastering the system of professional knowledge, competences and skills while achieving educational goals. In fact, it means that the awareness of the extent of formation of certain types of learning strategies (both cognitive and metacognitive) gives the opportunity to manage the process of studies in higher education institutions, on the one hand, and, on the other hand, to ensure better results of studies in higher education institutions by means of development and formation of the operational sphere of students’ studies — the complexes of activities of different levels which let them organize and manage their own studies.

A large part of the research carried out in this sphere (M. A. Kholodnaya, R. Sternberg) [14] is focused on the analysis of the level of development of the so called “universal learning competences” and on the description of their component structure. But it is not just the operational composition of the “abilities to learn” itself that is of interest, but the psychological substratum which is the basis for their formation and development. It is a well-known fact that in the same pedagogic conditions (the same programme, system of requirements and tasks) we can see different levels of the ability to study in pupils studying in the same class. And vice versa, those studying different educational programmes in different schools often demonstrate equally low level of formation of the components of studies. Under these circumstances, a reasonable question arises about the reasons contributing to or preventing the development of studies, about the factors determining the level of formation of educational activities. From our point of view, psychological peculiarities of pupils — cognitive, motivational and behavioural characteristics of a person

which constitute the resource of the development of a pupil or a student as a subject of studies — can act as such factors. In this article, we focused on the analysis of psychological characteristics that are highly likely to be able to ensure a high level of formation of cognitive learning strategies.

So, cognitive learning strategies are the strategies that let us effectively acquire studies-related information. Among them, the most typical of studies are the following ones:

1. Repetitions, which let us retain the information in short-term memory and do not require serious processing of the things we have learnt (remembering, retelling, picking out key concepts, rendering, re-writing, etc.).
2. Elaboration (giving more details about something) aimed at clarifying, exploring, developing and processing the content of the learnt material (finding examples, using it in practice, widening the scope of the content using similar facts from other sources, creating concept classification of the text, paraphrasing, generating questions about the content, etc.).
3. Organization of studies-related material involving transformation of the content into different forms — charts, tables, graphs (grouping, classifying, ordering, identifying the main ideas, creating generalizing concept tables).

The study of these cognitive strategies in particular is caused by the fact that technologies and ways that let us work with a large amount of information are of greatest importance when we need to master studies-related content. Besides, at the first stages of higher education the prevailing tasks are the ones that are related to the ability to work with a large amount of information.

Sample Characteristic:

The research was carried out on the basis of St. Petersburg state University. The study involved 293 students from the 1st, 3rd, and 4th courses of the university. The students who took part in the research are enrolled in the following faculties: the faculty of Medicine — 1st year students (53 students), Linguistics faculty — 1st year students (37 students), the faculty of Applied Mathematics and Control Processes — 1st course (33 students), Chemistry department — 3rd year students (30 students), and 4th year students (12 students), the faculty of Mathematics and Mechanics — 4th year students (40 students), the faculty of Philosophy — 5th year students (88 people). The average age of participants is 20 years old.

In order to accomplish the objective of the research, which is — to define the psychological factors which form the basis of cognitive learning strategies — it was important to select the students with a high level development of educational strategies (HLDES).

The group with the highest rate of the cognitive strategies development included the testees, whose values exceeded the average value by less than $\frac{1}{2}$ (the arithmetic average is 75,35), while the second group included only those participants whose values are lower than $\frac{1}{2}$ of the standard deviation from the average value (the arithmetic average is 63,65). [16] Accordingly, the group with a high level of the educational strategies development was 83 students.

The Method

To determine the sum of the psychological variables, which are most likely able to determine a high level of the cognitive training strategies development, the data obtained from the group of students with HLDES was exposed to factor analysis.

The data was originally obtained from the entire selection of students as a result of psychodiagnostic assessment of the three basic psychological spheres of students: cognitive, motivational and personal, behavioral, and also from the characteristics of temporal perspective.

The selection of the psychodiagnostic methods was carried out basing on the fact, that psychological factors, which underlie the formation of the learning strategies, may be determined by the different sides of students' personalities, including their intellectual abilities, motivation, attitude to learning, self-organization, etc.

The psychodiagnostic tools for the analysis of the students' cognitive sphere included the study of the conceptual system and intelligence, based on the following techniques: "Formulation of the problems" by M. A. Kholodnaya, "Metacognitive awareness" by M. A. Kholodnaya, "The perfect computer" by M. A. Kholodnaya, "Constructing the world" by E. J. Savina, "Included figures" (by Witkin, Oltman, Raskin, Karp) [14].

For the diagnostics of the value orientations and motivation system we used the following techniques: "Value orientations" by M. Rokich, Smekailo-Kucher's methods of study of the personal orientation, "Questionnaire of the personal self-actualization" by L. I. Gozman, Y. E. Aleshina, A. V. Lazukin, questionnaire "The motivation of success and the fear of a failure" by A. A. Rean.

To study the characteristic features we used the individual measures reflexivity determining method by A. Karpov, and the 16-factor personality questionnaire by R. B. Cattell. The temporal perspective system of the individual was estimated on the basis of the questionnaire "The time perspective" by F. Zimbardo), and the level of self-regulation was estimated by means of the technique "Style of the behavior self-regulation — 98" by V. I. Morosanova. To diagnose the level of educational strategies formation we used the questionnaire "Learning strategies" by S. N. Kostromina, T. A. Dvornikova [17].

In total 13 methods were used.

In the first stage of the data analysis we made the calculation of the correlation matrix for all variables used in the study (63 variables). Further, for the factor analysis, we selected the variables, the interaction of which determines the greatest proportion of the remaining total variance [18]. These variables with the biggest impact on the factor structure, are shown in table 2. The procedure of factor analysis is conducted by use of the principal component analysis.

Results and Their Discussion

The check of multivariate normal distribution (Bartlett criterion) and of sample adequacy (Kaiser — Meyer — Olkin criterion) showed the validity of the use of factor analysis results for further interpretation of the results (table 1).

Table 1. Adequacy measure and Bartlett criterion

| | | |
|----------------------------------------------------|------------------------|---------|
| Kaiser — Meyer — Olkin measure of sample adequacy. | | .657 |
| Bartlett sphericity criterion | Approximate chi-square | 204.552 |
| | | |
| | Level of significance | .000 |

Cumulative percentage of dispersion (before and after rotation) obtained by Varimax method for the two chosen components was 51.127 %, which is quite appropriate for further interpretation of results.

Table 2 shows rotated component matrix, in which 2 factors explaining the level of formation of cognitive learning strategies were identified.

Table 2. Rotated Component Matrix

| | 1 | 2 |
|-----------------------------------------------------|-------------|-------------|
| Communication (SAI) | .746 | -.180 |
| Orientation towards time (SAI) | .724 | .259 |
| Motivation for success | .708 | .231 |
| Need for cognition (SAI) | .658 | .221 |
| General level of self-regulation | .641 | .232 |
| Autonomy (SAI) | .623 | -.533 |
| Self-reflection | .125 | .818 |
| G "high normativity of behaviour" (Cattell) | .246 | .666 |
| Q3 "high level of self-control" (Cattell) | .217 | .551 |
| General self-esteem (metacognitive awareness) | | .469 |
| Discrimination method: Principal component analysis | | |
| Rotation method: Varimax with Kaiser normalization | | |
| Rotation converged in 3 iterations. | | |

The first factor included axiological variables and general self-regulation parameter. The second factor is represented by personality characteristics and by the characteristics of metacognitive experience. Let us consider each factor in more detail.

Thus, the first factor is formed by the variables which show the "style" of the person's activity through their motivation and value orientation. These parameters are: "**communication**" (SAI), "**orientation towards time**" (SAI), "**need for cognition**" (SAI), "**autonomy**" (SAI) and "**general level of self-regulation**". Let us analyze them one by one.

Need for cognition is the inner condition for personal development [19] because only knowledge gives the opportunity to widen your view of yourself and of the world around you and to include it into your experience. But the complexity and the variety of this knowledge depend on the effort the subject makes when dealing with educational material. That is why we can see such parameters as "autonomy", "communication" and "general self-regulation" in the structure of the identified factor. The subject's activity in obtaining new information and getting new experience is realized through self-disclosure, fulfilling your potential and regulating your activity.

According to V.I. Morosanova, [20] "the general level of self-regulation" includes all the components of the control of your activity: modelling (the development of understanding of the system of inner and outer significant conditions), planning (individual peculiarities in setting and pursuing the goal), programming (conscious programming of your activities), flexibility (the ability to adapt your system of self-regulation), independence (autonomy in organization of your own activity) and assessment of results (the adequacy of assessment of your own activity). The spectrum of these characteristics enables you to correct the activity if the motive changes or if the result does not correspond to the

desired one, thus enhancing the effectiveness of your activity. Due to a high level of self-regulation, the person is able to organize themselves and their educational space and set goals aiming to achieve them successfully.

Of crucial importance is the fact that one of the strategies determining the level of development of cognitive strategies is the variable connected with time — “orientation towards time”. Characterizing the personality of such students, we can say that they understand the existential value of life “here and now” very well. They can enjoy the current moment without comparing it to past joys and anticipation of future success. Interestingly, it is this parameter that has a meaningful connection with cognitive learning strategies. To process a volume of information, the person really needs to refer to past experience containing knowledge about the methods used in tackling some educational task. And it is important to relate it to the present moment in order to assess the appropriateness of the use of the strategies for the present task with orientation towards the possibility of using these strategies for the future result. Therefore, we can say that this parameter is involved in making a decision about the use of strategies of information processing for the given educational task.

On the whole, in the first parameter we can see a combination of parameters of self-regulation and self-actualization. This allows us to make a conclusion that its content describes the system of your own development and revealing your talents and abilities with the help of various learning strategies. This factor combines a complex of characteristics allowing you to create a system of information processing, mastering new ways of its digestion and absorption and choosing the ones that are suitable for a certain educational task. They describe the style of realization of your intellectual potential (to become what you can become), aspiration to actualize your abilities in the process of mastering the activity and acquiring new cognitive experience. In this process, cognitive learning strategies are the necessary tool for self-development; they reveal a wide scope of interrelationships between a personality and the world around them. The content of this factor allows us to call it the **“Factor of constructing your personal educational space”**.

The second factor includes the variables which, on the one hand, allow students to follow and assess the development of their cognitive activity. These are the following parameters: self-reflection, general self-esteem (metacognitive awareness, according to M. A. Kholodnaya). And on the other hand, they describe their characterological peculiarities which are responsible for following the rules of conduct while achieving the set goals and for the level of inner control of behaviour. These are the following parameters: factor G — “high normativity of behaviour” (Cattell) and factor Q — “high level of self-control” (Cattell).

Taken together, the parameters constituting the second factor show that in order to digest educational information independently, to process it and gain new experience, it is necessary to regulate this process. Students solve educational problems through understanding their cognition process, the capability to assess the level of their abilities, and meeting the requirements and standards of real life. It is these parameters that play a role in the choice of goals and the ways to achieve them.

Self-reflection and self-esteem are important components of movement towards the result, which give the opportunity to assess yourself and the obtained result. If they are combined with high normativity of behaviour, they provide achievement of intermediate goals and accomplishment of intermediate tasks and their correction while engaged in the activity (improving and rectifying).

For example, in order to solve a certain educational problem (working with the text, making notes on the topic, creating generalizing tables, charts, formulating definitions, etc.) it is necessary to analyze a specific learning situation, the defined requirements and conditions. And here both cognitive and personal processes are involved. Thus, the structure of the second factor confirms the ideas of S. L. Rubinstein and B. G. Ananyev [21] about the dependence of any successful activity not only on the effectiveness of actions but on personal characteristics as well. The personality controls the process of movement from the goal to the result, and determines the possibility of completing the activity and the degree of success.

Further on the way from the goal to the result, it is necessary to choose the means of achieving the goal (select the most appropriate ones and understand which of them “I can use best of all”) and to assess your resources (available and necessary). In fact, we mean that during the process of intensive studies, constant accumulation and generalization of metacognitive experience is going on.

The combination of parameters constituting the second factor enables us to call it **“Regulative”**.

Conclusions

Summing up the results of the factor analysis of psychological characteristics that determine a high level of the formation of cognitive learning strategies, we can make the following conclusion. The psychological characteristics responsible for the high level of the formation of cognitive learning strategies in this case are those that, on the one hand, reveal the individual creative style of activity, provide self-disclosure in learning with orientation towards success — the factor of “constructing your personal space”. On the other hand, they are responsible for achieving the set goals, conscious management of the process of learning, its control and comparison with the system of requirements — the “regulative” factor.

Both factors contribute to the development of “the ability to learn”, which is so important for students. They form the basis for reinforcement and widening of the operational system of studies, give an opportunity to actively use different ways of acquiring new knowledge and mastering new types of activity, and to increase the rate and the volume of digestion of educational information.

Summary

At present, a growing interest in research in the sphere of “metacognition” is noted. There is a number of works which consider this phenomenon from different angles. But they are united by the search for the answer to the question about the nature of the person’s knowledge and understanding of their cognition process and of the ways to effectively organize their cognition process. Undertaking the research into cognitive learning strategies enables us to widen the range of tasks focusing on the dynamics of development of the operational repertoire of studies, the formation of which is not finished at school but continues throughout the period of person’s studies, even in adulthood. With the help of the analysis of psychological factors reflecting the development of cognitive learning strategies we are given an opportunity to study educational environment which is an important condition for the formation of professional competence of future specialists.

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For citation: Kostromina S. N., Dvornikova T. A. Psychological Factors of Cognitive Learning Strategies Formation in Students. *Vestnik SPbSU. Series 16. Psychology. Education*, 2016, issue 4, pp. 110–119. DOI: 10.21638/11701/spbu16.2016.409

Received: 23.02.2016

Accepted: 11.10.2016