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Cognitive Strategies of Searching for Individual Work Methods in Blue-Collar Occupations

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Abstract: The role of cognitive processes in adapting individual work methods to labor conditions (objective and subjective) in blue-collar occupations with a high level of stereotypization has been poorly studied. Our hypothesis about the difference in cognitive strategies of searching for Individual Methods to Perform Technological Operations (IMPTO) has been checked in an industrial enterprise and with a laboratory model. An original method has been used. The paper reveals and describes the cognitive strategies of goal-oriented, evaluative and unintentional search for IMPTO in case of stereotypization. The obtained results have applied significance for the practice of professional training and the development of recommendations to overcome monotony of labor. From the theoretical viewpoint, the results are useful for specifying the regularities in the functioning of the metaconscious representation of experience as well as the links between the cognitive and regulative components of labor activity.

Key words: Individual work method, cognitive strategies, goal-oriented, evaluative and unintentional search for techniques, stereotypization, professional training

INTRODUCTION

This study covers stereotyped labor activity typical for modern industrial production: operating semi-automated machines and numerical control machines, in-line assembly etc. It strictly regulates labor techniques and hardly admits variations; however, variations are possible at the "micro-level" (succession and characteristics of movements, tempo, hand and finger position etc.). During their training, when workers receive general information about labor techniques (normatively approved way of activity), they should find individual variants of methods (techniques) to perform technological operations by themselves. Thus, a way of activity specific for a particular worker is developed. Shadrikov introduces a concept of "individual work method" to denote this reality. Researchers should distinguish between "individual work method" and "individual work style". The latter concerns some individual peculiarities of a worker as it is in the case of blue-collar occupations. Here arises a question, how an individual work method is developed and what is the role of the worker in this process. Shadrikov writes that it is up to the apprentice to decide how to implement a normatively approved work method in their actions. How does this process work?

Skills can be mastered with various degree of cognitive involvement and comprehension of particular components of activity with the aim to correct them as it is noted in some works including Konopkin (1980), Tolochek (2000, 2015). Within the metasystem approach to the organization of personality, Karpov (2004) expresses a fundamental idea of metacognition as an integrative process of regulating psychological system of activity.

Kluwe (1982) considers metacognition as processes of monitoring and regulation. The processes of monitoring help to identify a current task, to check for progress while performing the task, to evaluate the degree of this progress and to predict the outcome of the performed task. The processes of regulation provide direction for thinking and enable a person to concentrate resources on a current task, to define a succession of steps to fulfill the task and to create a focus on a certain level of intensity or speed of the task performance.

The results of some studies indicate a positive link between motivation, wide use of strategies and critical thinking (Clause *et al*., 2001). Workers use various sources of information, including metacognitive analysis of actions when they develop their skills. Beilock and Carr (2001) think that competence in some area (apart from such non-metacognitive processes as temporary memory and motivation) can include metacognitive reasoning as well. Competence is explained by differences in knowledge. Thus, many processes that involve using this knowledge are more or less automatic and therefore, they do not pose excessive demands to temporary memory.

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This enables metacognitive evaluation of a situation and structuring the process of achieving personal goal. One can assume that individual differences exist in both the Individual Methods of Performing Technological Operations (IMPTO) and cognitive strategies of their development. The aim of this research is to reveal and describe the cognitive strategies that workers use to develop IMPTO.

MATERIALS AND METHODS

The research was conducted directly in the industrial enterprises of Yaroslavl, Rybinsk and Ivanovo. The study involved about 200 workers in 12 production sites. For the mass study, the authors used simplified methods described by Klimina (1984). IMPTO were studied extensively in two sites: workers who operate semi-automated machines in the Dizelapparatura production association, pen assemblers in the Orgtekhnika association in Yaroslavl (38 workers aged from 31-48). The study period was 2.5 year.

At the first stage, detailed descriptions of the IMPTO used by the workers in the experimental site were made. The authors used the method of involved supervision, interview, labor method and analysis of documents. At the second stage, the strategies of developing IMPTO in each worker were revealed. Researchers used the method researchers worked out earlier (Klimina, 1984). The completeness of verbalization of particular components of work methods and conditions served as an indicator of mental activity in developing IMPTO. The use of this principle at any stage of professionalization is based on the regularities of unintentional memorization: the role of thinking activity and the attitude to the goal of activity. Verbal accounts of respondents (written and oral) were analyzed using a system of criteria.

- Completeness and specification of the verbal account in describing ways to perform production operations (conscious and unconscious IMPTO components were revealed)
- Completeness and content of arguments in explaining the reasons for the IMPTO development (the awareness about the links between conditions and techniques is revealed)
- Knowledge of the ways other workers work, ability to compare and analyze them (the degree of activity of the cognitive actions focused on the IMPTO elements is revealed)
- Knowledge of the possibilities to change the conditions of activity and implementation of these possibilities (indicator of cognitive actions aimed to transform the conditions of activity)

At the third stage, the strategies of developing the IMPTO were studied in the laboratory. The activity of an assembler in case of stereotypization was modeled. The goal of the laboratory stage was to reveal the cognitive strategies of developing the IMPTO by comparing supervised practical trials with the verbal accounts explaining them. During 8 experimental sessions, the respondents (students with no professional experience as assemblers) were assembling nods from the details of the Shkolnik construction kit according to a set technology.

Three operations (bracket attachment, angle fastening and plate fixing) were repeated over 200 times. The respondents had been thoroughly instructed about the assembly technique. The experimenter and two assistants registered the peculiarities of individual work methods of each respondent in the external structure of the activity. After the session, they were compared to the respondents' verbal accounts related to the internal structure of the activity: the description of an assembly method and explanation of the reasons that affect the specifics of the method. The basic operations were timed and the quality of assembly was controlled. All peculiarities of performing the technological operations (succession of movements, use of a tool, layout of details on the table as well as space, time and energy characteristics of movements) were registered. All changes of the specified characteristics were registered as trials in action. Thus, a changed succession of fastenings could indicate a search for a more rational succession in assembling a node. The final conclusion about this followed the interview. The experiment was conducted for 3 month.

RESULTS AND DISCUSSION

The program of study in real production activity enabled us to identify 3 groups of workers which differ according to the specified criteria. The results are given in Table 1.

Group 1 (11% of respondents): The workers give a thorough and detailed description of individual techniques which is adequate to the supervised ones. They are confident in answering the examiner's questions both while performing the operation that they describe in the work place and in other time, outside the work place. It is important that the respondents answer the questions readily. The descriptions of techniques involve rather individual peculiarities of the performed operation than its technological characteristics: how ("holding lightly", "lifting") in which hand ("at this time I hold everything in my right hand"). The verbalized characteristics of techniques are the result of conscious cognitive

Table 1: Comparative characteristic of strategies used to develop individual methods of performing technological operations (IMPTO) in various groups of workers

Criteria of analyzing IMPTO strategies	Group 1	Group 2	Group 3
Identification (realization) of the IMPTO elements: complete original description	Many IMPTO elements are identified. The description is detailed and original	The most essential IMPTO elements are identified. The description is less detailed and not original	IMPTO elements are not identified
Identification (realization) of conditions of IMPTO actualization: completeness of explanation	Quite complete. Meaningful explanation of IMPTO	Not identified or partially identified	Not identified
Characteristics of search for the IMPTO techniques	Search for the IMPTO techniques	Selection of IMPTO techniques	Occasional actualization of IMPTO techniques
Activity of transforming the conditions of activity	Transformation of the conditions	Taking the conditions into account	Insufficient agreement of the conditions and techniques
Characteristics of the IMPTO techniques	Original and optimal techniques	Mostly rational but unoriginal techniques	Non-rational techniques

operations with these characteristics. The workers from this group meaningfully explain why they prefer their individual techniques and realize that the techniques depend on the conditions of activity. They also realize the goal of searching for more efficient IMPTO which enables them to work faster, better and with less effort. Besides, they know the techniques of their colleagues and can compare them in some respect as well as evaluate them.

This indicates an active cognitive work aimed at cognizing the techniques. However, being aware of the working techniques of their colleagues, the workers do not copy them. Indeed, they find their own techniques. This is evidenced from the original techniques and notes on the necessity to search for a personal technique in the written accounts. In the result, the optimal correspondence between the individual techniques and conditions of activity (permanent and changing) is achieved.

Group 2 (81% of respondents): The workers from this group give less detailed descriptions of techniques; there are no indications of individual peculiarities. They rather realize the set technology of performing an operation than an individual approach. They do not explain why they use their techniques and do not reveal the reasons for choosing the techniques. “I did it well this way several times so, I continued”, “It’s more convenient for me”, “It’s a habit”.

The workers from this group realize that there are other techniques to perform the technological operations but can neither analyze them nor compare them in any respect. They do not realize the goals of searching for individual techniques. The workers do not analyze the techniques and conditions of their work. They do not see it necessary to search for new techniques: “I can meet the quota anyway”. This group does not show any original techniques, the workers copy the techniques of their colleagues and change them only unconsciously. They realize only comparative empirical evaluations: “It’s more convenient”, “It’s faster”. In this case, the individual performance techniques reflect the conditions of the activity and individual peculiarities of the worker to a lesser degree.

Group 3 (8% of respondents): The workers from this group give a very poor description of their individual techniques employed to perform the operations. In many cases, in response to our request to describe a method, they become thoughtful and try to watch their hands. Sometimes, when the interview is taken far from the machine, they say, “I can’t remember. I’d rather show you” (and try to approach the machine). Perhaps, they did not analyze their techniques and did not think about their efficiency before the study. The workers cannot explain why they have chosen these very techniques; however, in most cases, they are positive toward the study. When they are asked about the differences between the techniques, they answer negatively, “Is it possible to work in various ways?” or “Others work in the same way”. This group has not demonstrated any facts of changing the conditions of their activity (for example, to distribute the details “according to hands”). Their work place is organized irrationally. Their individual techniques themselves are irrational; there are many unnecessary movements. This type involves unconscious development of individual techniques with no account for the conditions of activity.

These three types of developing individual techniques are quite sustainable. They were revealed in workers in various periods of study even when they were shifted to another area of work.

Here are the results of the laboratory experiment. The laboratory experiment has confirmed that there are many

individual variants of performing technological operations at the level of movements and hand involvement (motor component). The strategies of their development (the cognitive component) vary, too. The respondents realized search trials registered in the experiment in various degree and with various explanations. As a result, researchers identified three types of the IMPTO search strategies.

Type 1: The respondents realize the existence of search trials: they mention them in their verbal accounts and explain why they perform the trials. It is stands out that the respondents analyze the techniques and conditions of performing operations. The analysis of the techniques is based on primary trials in action which form the basis for getting the necessary information; the primary technique of performing an operation is evaluated. Negative evaluation entails setting a goal of searching for a new technique.

During the search, the workers find out why a technique has drawbacks, identify the elements of the technique and analyze and the conditions. For example, respondent L.T. immediately begins to perform the operation of bracket attachment in the 2nd session. She explains after the session, "I thought that if I inserted the screw first, it would be difficult to insert the nut: the gap is small so, I have to insert the nut first and then the screw". The respondent analyzes her technique, identifies its elements ("to insert the screw", "to adjust the nut") and realizes that it is the properties of the details that cause difficulties: "The gap is small". Then, the logic of the search enables her to eliminate the reason of inconvenience, i.e., enlarge the gap. In this case, the content of the technique singled out into elements and the conditions of its implementation are realized and act as objects of cognition. The search is directed by the goal to improve the technique. The presence of a goal indicates that the structure of activity involves intellectual actions which can be separated from the practical ones. This is proved by the registered facts of separating practical trials and intellectual actions in time. Researchers called this cognitive strategy the strategy of goal-oriented search.

Type 2: The respondents realize that the technique is changed; however, they cannot explain meaningfully the reason for the change. They are not completely aware of their individual techniques and ignore the link between the techniques and conditions. It is only the result of the search (the new variant) that is realized. Besides, the respondents give a comparative evaluation of the new technique in comparison with the old one: "more convenient" instead of "convenient". The respondents report in their verbal accounts that the technique has appeared unexpectedly, "I don't know. It did it this way and then it became a habit" (respondent N.P., third session). Here is an abstract from the recorded interview with respondent A.L. after the fourth session:

> Respondent another new thing. First, I inserted the screws in the angle and then in the panel, and now I adjust the angle and the screws at once. I do it...unconsciously, I'd say. I cannot explain why. Experimenter: Is it better or worse? Respondent: I think it is better...Yes. But I evaluate it only when I see that I insert it in another way

Operating integrated models of techniques found by practical trials is the main distinctive feature of cognitive strategies. The techniques are not singled out into separate elements because researchers have rather a selection of individual variants directed by the evaluation ("better", "more convenient") than the "building" of techniques. Researchers called this strategy the strategy of evaluative search.

Type 3: The respondents do not realize that the elements of the technique have changed even if the experimenter directly indicates it in a post-experimental interview. Thus, respondent M.K. reports after the second session, "Perhaps, it is. I did not notice. I just went on screwing." Such trials enable the respondents to choose ways to perform auxiliary operations in this experiment. For example, "I paid little attention to the position of the angle; I was focused on fastening the screw." Researchers called this cognitive strategy the strategy of unintentional search. The essence of unintentional search is that it is not directed by a consciously set goal and registered practical trials are not realized. Cognitive involvement in the activity is extremely low.

Summing up the results of the previous stages of the study, researchers conclude that the workers in the first group mostly use cognitive strategies of goal-oriented search for individual techniques: the goal of the search is realized and the characteristics of individual techniques and the conditions of their performance become the objects of thought. The activity structure involves appropriate intellectual actions. The workers in the second group use the strategies of evaluative search: the respondents realize that the technique has changed and it is only evaluation of the changed technique ("faster", "more convenient") that becomes the object of thought. The workers in the third group mostly use the strategies of unintentional search.

The obtained results agree with the acceptance of conscious and unconscious mechanisms of individual work methods development and implementation. The conscious mechanisms involve the manifestations of reflection and choice of work methods while the unconscious mechanisms include emotional experience of convenience and preference or difficulty and discomfort that accompany the activity (Tolochek, 2015).

The conducted study enables us to find actions in the activity structure whose subject is the content of individual techniques of performing technological operations. Researchers can assume that researchers deal with reflection. The goal of reflexive actions is to adapt an action method to the objective and subjective conditions of the activity. Highly automated skills are the main actions that implement a goal of stereotyped working activity-production. Reflection does not change their essence. Reflexive actions are involved in the activity structure as independent actions and become "knowledge of an action" (a verbal model of a motor component and conditions of performing an action). This knowledge is no more "informative"; it becomes "operational" or instrumental (Karpov, 2004). It happens because knowledge is revealed as the content of the psyche which earlier is necessarily represented in a conscious form (i.e., realized) but then can acquire another form and transform into the metaconscious.

The concept of the "metacognitive form of representing experience" enables us to explain the mechanism of the evaluative search strategy (the most widespread). It was revealed in 80% of the workers in the sample of 200 people (12 production sites). The essence of the evaluative search strategy is that the process of search can function at the level of trials in action ("I did it well once and then I continued to work in this way"). The consciousness works and is included in the activity only for comparative evaluation of the acceptability and convenience of the ways to perform technological operations ("easier", "more convenient", "faster"). It is enough to achieve the goal of the activity ("We can meet the quota anyway"). Here, we have the principles of selectivity and economy of psychological resources. The activity model is narrowed. The level of consciousness involves only emotional evaluation; however, it could be impossible without metaconscious representation of the IMPTO. The essence of a metaconscious form is that in organizing and implementing an activity, it helps to account for the knowledge that a person really has though it is not represented in this moment.

However, it is an effective determinant of voluntary regulation. The "convenient" methods of work revealed by workers are kept in the metaconscious form. This form of representing experience involves both meaningful and operational information, the information about "what" to do and "how" to do in all the details and aspects. The strategy of evaluative search for individual techniques to perform technological operations is a selection of techniques from the known and unintentionally revealed ones and a reproductive type of activity organization. The necessity of searching for the IMPTO techniques is not realized.

The awareness of the goal of searching for individual techniques and the reflection of motor components and conditions of the activity aimed to optimize it is a higher level of organizing activity. It is based on the principle of productivity as it involves finding a new, "personal" way. The analysis of the techniques and conditions of work and search for more efficient IMPTO is a manifestation of a higher level of organizing professional activity and a higher competence as integration of all forms of experience which characterizes the strategy of goal-oriented search (revealed in 11% of workers).

These are the best workers as confirmed by the evaluation of their work according to the parameters of economic efficiency (Klimina, 1984). The study of Kholodnaya (2004) has shown that this is quite a different quality of activity according to both processual and resultative characteristics. In this case, activity is enriched by the acts of cognitive and regulative reflection and therefore, is perceived as more meaningful. Workers implement their intellectual potential and labor is perceived as more meaningful, the subjective evaluation of work increases and work satisfaction rises.

Why do the revealed strategies appear? We did not pose this question in the study. However, the results of our observations and interviews and all the obtained information allow us to assume that cognitive involvement in the process of developing individual way to perform technological operations is rather linked to a person's attitude to their activity and work process than their level of intellectual development. Moreover, the motivational component is the most significant. Researchers can assume that motivation together with the level of intellectual development and intellectual needs determine the appearance of reflexive actions.

This assumption is confirmed by the analysis of the results obtained in another group of workers which mostly use the strategy of unintentional search for IMPTO (8% of the sample). Weak cognitive involvement results in the destruction of the regulative component of activity which manifests itself in chaotic movements and destruction of the motor component. (For instance, a worker in the pen assembly site makes many unnecessary

movements and fusses about. The movements of her hands are fast but the assembly goes slowly). The workers in this group have low or negative working motivation which affects the overall psychological structure of the activity.

CONCLUSION

This study has revealed new actions in the activity structure in some of the workers. These actions are initiated by a worker and are aimed to cognize and transform the content of the executive component of their activity which lets us speak about the qualitative changes of the activity itself due to metacognitive knowledge and metacognitive activity.

The involvement of various levels of metaconsciousness in the process of activity is revealed in various cognitive strategies of searching for individual ways to perform technological operations. The article reveals and describes three cognitive strategies of the search: goal-oriented search strategy, evaluative search strategy and unintentional search strategy.

Metacognitive involvement in working activity develops more efficient individual work methods according to the parameters of economic efficiency-labor capacity and quality of manufactured products. The knowledge of the action's peculiarities and account for the work conditions and personal individual peculiarities indicate a higher level of professional competence as integration of all forms of experience which characterizes the strategy of goal-oriented search.

The involvement of intellectual (reflexive) cognitive acts in the activity structure and the transformation of the work methods and conditions enrich the content of the activity which is manifested in the increased subjective evaluation of work and work satisfaction. Comparing the described cognitive strategies, different in the level of cognitive involvement in the activity, enables us to evaluate the impact of the metaconscious form of representing professional experience on the process and result of work. Besides, it allows researchers to consider metacognitivism as a new paradigm of studying labor activity and a way to increase its efficiency.

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REFERENCES

Beilock, S.L. and T.H. Carr, 2001. On the fragility of skilled performance: What governs choking under pressure?. J. Exp. Psychol. Gen., 130: 701-725.

Clause, C.S., K. Delbridge, N. Schmitt, D. Chan and D. Jennings, 2001. Test preparation activities and employment test performance. Hum. Perform., 14: 149-167.

Karpov, A.V., 2004. [Metasystem Organization of Level Structures of the Psyche]. RAN Publisher, ?oscow, Russia, (In Russian).

Kholodnaya, M.A., 2004. [Cognitive Styles: On the Nature of Individual Mind]. Piter Publisher, Saint-Petersburg, Russia, (In Russian).

Klimina, T.B., 1984. [Thinking activity in stereotyped labor activity: On the material of mass working professions]. Master Thesis, Moscow State Linguistic University, ?oscow, Russia. (In Russian)

Kluwe, R.H., 1982. Cognitive Knowledge and Executive Control: Metacognition. In: Animal Mind-Human Mind, Griffin, D.R. (Ed.). Springer, NewYork, USA., pp: 201-224.

Konopkin, ?.?., 1980. [Psychological Mechanisms of Regulating Activity]. Nauka Publisher, ?oscow, Russia, (In Russian).

Tolochek, V.A., 2015. [Styles of activity: Resource approach]. Institut Psikhologii RAN (Ipran), GU, ?oscow, Russia. (In Russian)

Tolochek, V.?., 2000. [Styles of Professional Activity]. Smysl Publisher, ?oscow, Russia, (In Russian).