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Job Specificity in Human Functional State Optimization by Means of Self-regulation Training

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Abstract

The paper is devoted to consideration of self-regulation training that can be used in order to prevent a development of negative human functional states (HFS) in work environment. According to the well-developed in Russian work and organizational psychology traditions the effects of practical implementation of various self-regulation methods on job efficiency and worker’s well-being are analyzed. The positive patterns of changes in HFS syndromes as the results of prolonged courses of self-regulation training are described. It is shown that a successful acquisition of self-regulation skills strongly depends on specificity of job content. These findings are useful for enhancing the quality of work-site stress management and health promotion programs.

Keywords: Occupational stress; Human functional state; Self-regulation; Stress management; Relaxation effects; Health promotion programs.

1. Introduction

Over the past decades one of the most important lines of research in Russian applied psychology concerns the elaboration and practical implementation of psycho-prophylactic programs and tools for enhancing personnel workability and preventing a development of negative human functional states (HFS) at different job conditions [1], [2]. Initially these studies were focused on correction and prevention of such negative HFS as acute fatigue, monotony/boredom, emotional overstrain, etc., which considered as the serious risk-factors for reliable work of operators in highly automated systems at military objects, aviation, rail-way traffic, complex industrial technologies, etc. Even at that time the accent was done not only on implementation of sufficient ergonomic redesign of the operator’s work places but also on the use of self-regulation techniques that could help a person to be more resistant to intensive workloads and job demands [3]. Recently this approach has been successfully developed and become a “core part” of stress-management (or, more correctly, HFS management)

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programs that are widely used in the psychological assistance services at civil enterprises. Among the occupational groups most frequently participated in such training programs there could be mentioned medical doctors, teachers, sellers, call-centre operators, office workers and athletes [4], [5], [6]. At the same time, a prospective development of this type of practice ought to be grounded on the relevant conceptual basis and scientifically verified data of empirical studies. The present paper is devoted to the methodology of HFS management research illustrated by the new findings in the effects of self-regulation training on workers’ well-being and job efficiency.

2. Basic principles of HFS management and self-regulation training

Human functional state (HFS) is one of the central concepts in Russian applied psychology initially developed in the field of work and engineering psychology and, recently, in organizational psychology [5]. Generally speaking, this concept concentrates on revealing the relations between the achieved level of work efficiency and individual resources of a worker that were utilized by him in order to perform job tasks. According to the activity regulation approach developed in Russian psychology, HFS is defined as a relatively stable integrative pattern of activated internal resources (physiological, cognitive and emotional) that highlights the mechanisms of activity regulation in the current situation and determines the efficiency of work performance in actual job conditions [2], [5]. The theoretical framework of HFS research is based on the data of job analysis in order to distinguish the sets of objective work factors that lead to changes in HFS. By means of this methodology, any type of HFS could be represented as a structural pattern of actualized physiological and mental functions which are involved in the process of work execution [2], [7].

In applied studies the main tasks of HFS management are usually considered as follows: (a) enhancement of work efficiency, (b) reduction of errors and false actions probability, (c) normalization of an actual workers’ mental and physical state, (d) prevention of negative chronic states accumulation (like chronic fatigue, emotional exhaustion, depression, etc.), (e) prophylactics of work-related somatic diseases. The individual’s capacity to maintain an adequate level of resources involved in work process helps to be effective in work. Thus, one of the promising ways to organize an efficient psychological support in job conditions is to elaborate and implement special programs targeted to optimize HFS at work and to teach people how to manage their states during the process of work execution.

Developed in Russian work and health psychology HFS management tools are to some extent similar to a Western framework for stress-management studies, since stress can be considered as one of the negative individual states. There are several categories of optimization methods and techniques which can be drastically differentiated by their “goal-orientation”. In one case their aim consists in elimination (or reduction) of influence of objectively demanding job conditions and intensive workloads (i.e., ergonomic redesign of workplaces and technical devices, normalization of work/rest schedules, etc.). Another category of methods relates to different ways of external stimulation or reassurance of a person – by using light psychopharmacological means, location in a more comfortable environment (functional music, multimedia compositions) or suggestion; in all these cases subjects have a passive position. The third category of methods is based on active learning of new habits and skills that can help subjects to overcome the difficulties by themselves – for instance, by training professional and communicative competencies, resolving conflict situations and applying other useful coping strategies. Different procedures of self-regulation training belong to the third category [5], [8].

Among the mentioned categories of HFS management methods self-regulation techniques build up the most promising group with respect: 1) to the subject’s active conscious participation in managing his/her own states, 2) to development of the so-called internal psychological HFS regulation skills, 3) to high usability of actualization of these skills when necessary - a person can use them at any time and in any place when and where it becomes necessary. All self-regulation techniques are oriented to learning special regulatory skills which after consolidation form the new and stable psychological habits of managing his/her own states. In work conditions these habits allow to transform an experienced non-optimal HFS to appropriate or optimal levels [3], [5]. These techniques include various tools of relaxation and subsequent mobilization of internal resources, which should be reached according to the near future work/activity tasks. Among them there are well-known techniques that are
useful for purposes of psychological HFS self-regulation, such as progressive relaxation, autogenic training and some intermediate methods based on the main similar principles, namely ideomotor training and visualization [5].

It is obvious, that psychological self-regulation skills are widely present in the psychological structure of any human being’s activity, and otherwise one would not be able to maintain one’s existence in the world. A new direction in self-regulation training with respect to HFS management in work is elaboration of special skills which could be developed during special self-regulation training courses and then used by the subject himself to manage his/her HFS in the most optimal way. Understanding of the optimal way implies such characteristics as high probability of reaching the required HFS level with respect to different work tasks, the limited time for the usage of HFS management procedures, full conscious understanding by a subject of the necessity and the targets of HFS management, and full conscious control of the ways of HFS regulation.

3. Efficiency of self-regulation training in different occupational groups

Over the past decades at the Laboratory of Work Psychology, Moscow State Lomonosov University there was conducted a wide range of empirical studies in order to elaborate the main principles of organization of self-regulation training courses and their direct implementation in work environment. The main purpose of these studies consisted in an integrative evaluation of the effects of different self-regulation techniques on dynamics of workers’ HFS manifestation in various occupational groups. It means that the sets of indices of the most important physiological and psychological functions were measured before, during and after the implementation of self-regulation courses. Then a comparative analysis of the collected data sets was produced. The results help to differentiate the dominant positive effects on HFS management programs depending on the specificity of job content and preferable types of self-regulation techniques in different occupational groups.

In general, the samples of nine occupational groups participated in the studies: (1) blue-collar workers of microelectronic plants, (2) industrial managers, (3) operators of high automated systems, (4) air-traffic controllers, (5) operators of booking offices, (6) accounting workers, (7) medical doctors, (8) school teachers and (9) students [5, 6]. In all groups the dynamics of individual’s HFS was evaluated by a complex of diagnostic indicators for measuring the changes in physiological, cognitive and subjective levels of activity regulation. In each group, this complex was assembled according to the context of the main professional tasks which was revealed by the results of job analysis. A combination of the used diagnostic measures was accomplished on the basis of the HFS research methodology according to two main postulates: a) the indicators should be adequate to the job content in concrete occupations, and b) experimental results obtained for different occupational groups should be comparable. The prepared diagnostic complex included: (1) several common physiological indices and indicators (blood pressure; heart rate; vegetative index Kerdo); (2) psychophysiological and cognitive performance tests (critical frequency of the flicker test (CFF); modified Burdon checking test); (3) subjective tests of self-estimation of HFS (well-being scale; Spielberger’s state-anxiety scale; acute fatigue scale) [1, 2, 6].

During each study three self-regulation techniques were used: (a) progressive neuro-muscular relaxation training; (b) sensory-motor imagination and image reproduction; (c) modified version of autogenic training. All these techniques were arranged in the form of sequential stages of acquisition of self-regulation habits and, in the whole, correspond to the basic elements in the unified complex system of self-regulation training [5]. Several additional rehabilitation procedures were used at each stage of the program (different types of breathing and muscular gymnastics, music and multimedia accompaniment). They were used in order to increase the relaxing and/or activating influences of self-regulation techniques. The effects of self-regulation techniques were compared with the results of diagnostics measures which were conducted during the whole training course. First, the specific effects of using self-regulation techniques in each of the occupational groups were identified, and then the main tendencies in dynamics of the background HFS level were evaluated with the respect to a prolonged usage of self-regulation techniques. Second, a comparison of efficiency of self-regulation training in different occupational groups was done. The influence of self-regulation training was evaluated in two forms: (a) Actual effects of self-regulation sessions. These effects can be evaluated by comparison of the data before and
after each self-regulation session during the training course. (b) **Prolonged effects** throughout the whole course of training. These effects can be revealed by a comparison of background data gathered before the training sessions at different stages of realization of the self-regulation program.

An overview of the collected data allows us to make the following predictions: (1) application of different self-regulation techniques leads to HFS optimization both in the respect of actual effects (immediately after each training session) and prolonged effects (stable positive cumulative changes); (2) the efficiency of different self-regulation techniques may have varied impacts on HFS dynamics in different occupational groups because of the specificity of job content and demanding work conditions; (3) self-regulation methods based on the active application of mental skills in the HFS management (sensory-motor imagination training and autogenic training) have more positive effects on those negative workers’ states which are strongly provoked by psychological factors. The results obtained show that the pronounced positive effects can be achieved while using every self-regulation techniques in all occupational groups. It has to be mentioned that the positive actual effects of the self-regulation sessions are clearly pronounced in all groups of particular HFS indicators. The type of achieved improvement of integrative HFS scores after each self-regulation sessions can be qualified as a general activity mobilization. This reflects a well-balanced enhancement of parameters of physiological and cognitive functioning as well as increase of subjective and emotional feelings. At the same time there are some specific effects which depend upon the differences between occupational groups. The changes in HFS indicators show that in each group there are several mental and psychophysiological indices which are more sensitive to the influence of self-regulation training. They correspond with the most important professional functions that are directly involved in the process of job execution. A specificity of the positive effects was also observed in the indicators of cognitive performance. After applying different self-regulation procedures both indicators of the Burdon checking test (accuracy and productivity) are growing. That means that the speed of the task execution increases, and the number of errors declines. This result could be interpreted in terms of minimization of the so-called “attention errors”, which usually occur when a worker's state changes from an “optimal level” to fatigue.

Concerning the prolonged effects of self-regulation training, the following results were obtained (see Table 1). When subjects were trained systematically, the positive results were reached with respect to all HFS indicators. The registered physiological indicators (blood pressure and heart rate) demonstrate a trend towards a general normalization: from mostly negative background values (either too high or too low) to the level of an optimal range. In general, the psychophysiological and cognitive performance indicators, as well as the indicators of HFS self-estimations and emotional feelings, are transformed in a positive way.

<table>
<thead>
<tr>
<th>Occupational groups</th>
<th>Blue collar workers</th>
<th>Industrial managers</th>
<th>Operators of high automated systems</th>
<th>Air-traffic controllers</th>
<th>Operators in booking offices</th>
<th>Accounting workers</th>
<th>Medical doctors</th>
<th>School teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>+!</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+?</td>
<td>+</td>
<td>+?</td>
</tr>
<tr>
<td>Well-being score</td>
<td>+</td>
<td>0</td>
<td>+?</td>
<td>+!</td>
<td>0</td>
<td>+!</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>State anxiety score</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Acute fatigue score</td>
<td>+1</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+!</td>
<td>0</td>
<td>+?</td>
<td>+?</td>
</tr>
<tr>
<td>Critical Fusion frequency</td>
<td>+?</td>
<td>0</td>
<td>+?</td>
<td>0</td>
<td>+!</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Accuracy in Checking Test</td>
<td>+!</td>
<td>0</td>
<td>+!</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Productivity in Checking Test</td>
<td>+!</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Chronic fatigue score</td>
<td>+</td>
<td>+?</td>
<td>+</td>
<td>+?</td>
<td>+?</td>
<td>+?</td>
<td>+</td>
<td>+?</td>
</tr>
</tbody>
</table>

The legend: **Positive effects**: +! (p < 0.01); + (p < 0.05); +? (p < 0.1). **No effects**: 0.
The mentioned positive prolonged effects were shown in all occupational groups, but their grades were different. For instance, in the group of accounting workers the positive changes in the background HFS scores started to be highly explicit even at the middle of self-regulation course. At the same time, in the group of operators in booking offices these changes were not so obvious. Such ambiguous (but only for the first sight) result reflects the extremely increased daily workloads in this occupational group during the whole period of implementation of self-regulation program. Nevertheless, to the end of the training course the background HFS level started to be increased positively. This trend could be interpreted as an improvement in such components of the operators’ HFS which suffered more under the influence of intensive workloads in the ordinary course of job execution.

Such deficiency of the HFS components is not the same in different occupations (see Table 2). The data obtained show that in the group of industrial managers the most explicit positive changes manifest themselves in normalization of physiological support of activity; in the group of air-traffic controllers - in the improvement of cognitive performance and increasing feelings of subjective comfort; in the group of operators in booking offices - in the decreasing of emotional tension and the increasing speed of information processing; in the group of accounting workers - in the decrease of acute fatigue symptoms and the increasing quality of visual information search.

<table>
<thead>
<tr>
<th>Occupational groups</th>
<th>Industrial managers</th>
<th>Air-traffic controllers</th>
<th>Booking offices staff</th>
<th>Accounting workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of effects</td>
<td>normalization of physiological support of activity</td>
<td>improving of cognitive support of activity;</td>
<td>decreasing emotional tension;</td>
<td>decreasing of acute fatigue;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increasing subjective comfort</td>
<td>increasing the speed of perception</td>
<td>increasing of quality of perceptual processing</td>
</tr>
</tbody>
</table>

The comparison of both actual and prolonged effects of self-regulation training demonstrated a cumulative character of the positive trends. While after the first sessions mostly in all occupational groups the HFS indicators showed a slight tendency towards positive changes, at the end of the training course this dynamics became vividly manifested and stable. These results demonstrate the gradual transformation of overt execution of self-regulation exercises into the special mental skills or a development of self-regulation habits.

The described above data could be summarized as follows. The positive effects of self-regulation training on workers’ well-being and mental functioning are distinctly manifested in all observed occupational groups. This improvement can be achieved by the use of all self-regulation techniques which were included in the proposed training program. A possibility of developing self-regulation habits makes a good basis for the prevention of human errors, losses of personnel workability and mental/physical health deterioration. At the same time, the obtained results show that the efficiency of the distinct self-regulation techniques is not equal. For instance, in the group of industrial managers the most positive dynamics was observed after using the progressive relaxation technique. In the air-traffic controllers’ group the most explicit results were achieved after the sessions with sensory-motor imagination and autogenic training. In the group of operators in booking offices and in the group of accounting workers the most pronounce positive dynamics took place at the end of the whole self-regulation course, e.g. after the session with autogenic training.

In addition, several general tendencies in manifestations of the efficiency of different self-regulation techniques have to be mentioned. First of all, the most distinct positive effect is always observed for some, but not for all HFS indicators, while the trends towards a HFS optimization in the whole are the same for all self-regulation techniques. Secondly, the most “psychologically-oriented” techniques - such as sensory-motor imagination and autogenic training - have a stronger effect on the emotional and cognitive components of activity regulations, while the progressive relaxation procedure makes it possible to normalize mostly the level of psychophysiological tension and to minimize negative exhaustion and psychosomatic complaints.
4. Conclusions and recommendations

The described results of the series of our studies provide an opportunity to formulate basic principles and to elaborate general recommendations for the practical implementation of self-regulation training programs. Systematic self-regulation training leads to a wide range of immediate and cumulated positive effects on a worker’s state and improvement of his/her workability. These positive changes are clearly presented in the data of restructuring of negative HFS syndromes, both actual and chronic. Accordingly, it is recommended to conduct self-regulation training courses during work shifts in order to prevent the negative consequences of intensive workloads and to avoid high-pressure of job environments. The application of self-regulation techniques is also recommended to implement in the form of short and intensive “active rest pauses” with a parallel control of achieved levels of recovery. Self-regulation methods are the most efficient in respect to those components of HFS that suffer more from intensive physical and mental loads which are typical for an everyday flow of work activities in different job settings.

The level of optimization effect can be differentiated depending on the type of self-regulation techniques. According to professional specificity their application should correspond to the dominant type of complications or deterioration in activity regulation process in particular occupational groups. Besides, the choice of an adequate self-regulation technique could be based on the causal analysis of typical work errors. If errors are caused by physical and mental exhaustion during prolonged work without rest, those self-regulation techniques would be more helpful if they allow to reduce psychophysiological tension and to increase feelings of subjective comfort and affective attitudes to work. Progressive relaxation training can be an example of such techniques. If distortions of job performance are caused by mental difficulties in work (i.e., intense cognitive demands, high responsibility, emotional strains, etc.) such psychologically enriched techniques as sensory-motor imagination or autogenic training seem to be more preferable.

References