INTER-RELAÇÃO ENTRE A ESTABILIDADE PSICOEMOCIONAL E A FORÇA OU A FRAQUEZA DO SISTEMA NERVOSO NO ASPECTO DA OCUPAÇÃO PROFISSIONAL DE OPERADORES DE PRODUÇÃO CONTÍNUA DE FIBRA DE VIDRO

INTERRELATION OF PSYCHOEMOTIONAL STABILITY AND STRENGTH OR WEAKNESS OF NERVOUS SYSTEM IN THE ASPECT OF PROFESSIONAL OCCUPATION OF GLASS FIBER CONTINUOUS PRODUCTION OPERATORS

ВЗАИМОСВЯЗЬ ПСИХОЭМОЦИОНАЛЬНОЙ УСТОЙЧИВОСТИ И СИЛЫ-СЛАБОСТИ НЕРВНОЙ СИСТЕМЫ В СТРУКТУРЕ ПРОФЕССИОНАЛЬНОЙ ДЕЯТЕЛЬНОСТИ ОПЕРАТОРОВ ПОЛУЧЕНИЯ НЕПРЕРЫВНОГО СТЕКЛОВОЛОКНА

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RESUMO

Aspectos teóricos de estudos de estabilidade psicoemocional e tipos de sistema nervoso e sua manifestação no aspecto da ocupação do operador são descritos no presente artigo. A análise dos resultados do estudo professiográfico foi realizada. O estudo incluiu os empregados (operadores de produção contínua de fibra de vidro) da fábrica de fibra de vidro “P-D Tatneft-Alabuga Steklovolokno, Llc”. Os critérios de sucesso profissional do operador foram descritos. Eles incluíram forte tipo de sistema nervoso e foram associados altos níveis de estabilidade psicoemocional durante o processo de produção tecnológica. Especial atenção foi dada aos resultados de estudos empíricos sobre a interconexão de estabilidade psicoemocional e tipos de sistemas nervosos em operadores “mais bem-sucedidos” de produção contínua de fibra de vidro e “menos bem-sucedidos”. Diferenças estatísticas nos parâmetros estudados, dependendo do grau de sucesso profissional dos entrevistados, foram obtidas durante a análise de correlação que revelou um tipo de sistema nervoso mais forte e alto nível de estabilidade psicoemocional em operadores “mais bem-sucedidos” e um tipo de sistema nervoso significativamente mais fraco e menor estabilidade em “operadoras de menor sucesso”.

Palavras-chave: operadores de produção contínua de fibra de vidro, estabilidade psicoemocional, sistema nervoso.

ABSTRACT

Theoretical aspects of psychoemotional stability studies and types of nervous system and their manifestation in the aspect of operator occupation are described in the present article. The analysis of the professiographic study results was performed. The study included the employees (glass fiber continuous production operators) of the glass fiber manufacturing plant “P-D Tatneft-Alabuga Steklovolokno, Llc”. The criteria of operator professional success were described. They included strong type of nervous system and were associated high psychoemotional stability levels during technological production process. Special attention was paid to the results of empirical studies on interconnection of psychoemotional stability and nervous system types in “more successful” and “less successful” glass fiber continuous production operators. Statistical differences in the studied parameters, depending on the degree of respondents professional success, were obtained during correlation analysis that revealed stronger nervous system type and high level of psychoemotional stability in “more successful” operators and significantly weaker nervous system type and lower stability in “less successful” operators.

Keywords: *glass fiber continuous production operators, psychoemotional stability, nervous system.*

АННОТАЦИЯ

В статье рассматриваются теоретические аспекты изучения психоэмоциональной устойчивости и типа нервной системы и их проявления в структуре операторского труда. Представлен анализ результатов профессиографического исследования, в котором приняли участие сотрудники предприятия по производству стекловолокна ООО «П-Д Татнефть-Алабуга Стекловолокно» (операторы получения непрерывного стекловолокна). Описаны критерии успешности в профессиональной деятельности оператора, среди которых можно выделить сильный тип нервной системы и обусловленный им высокий уровень психоэмоциональной устойчивости в условиях производственно-технологического процесса. Особое внимание уделено результатам эмпирического исследования взаимосвязи показателей психоэмоциональной устойчивости и типа нервной системы у «более успешных» и «менее успешных» операторов получения непрерывного стекловолокна. Также приводятся статистические различия по исследуемым показателям в зависимости от степени успешности респондентов в профессиональной деятельности, данные были получены в ходе корреляционного анализа, который показал наличие сильного типа нервной системы и высокого уровня психоэмоциональной устойчивости у «более успешных» операторов и значительно более низкие проявления силы нервной системы и устойчивости у «менее успешных» операторов.

Ключевые слова: *оператор получения непрерывного стекловолокна, психоэмоциональная устойчивость, нервная система.*

INTRODUCTION

As technological progress becomes the main factor of human activity efficiency, closer attention is paid to different spheres of conveyor-based production and industrial labor. In such conditions, human personality should be addressed as well. In modern psychology, human factor attracts researchers interest in some understudies occupations, like glass fiber continuous production operator (GFCP operator). According to the Standard Wage-Rates and Skills Reference Book (SWRSRB), GFCP operator is responsible for technological process of glass fiber continuous production, instrumental or visual equipment adjustment, equipment mode set up, start and lock down of technological line equipment, glass fiber drawing technological failures handling and regulation of such technological parameters as drawing rate, level and temperature in tanks (Unified rating and skills..., 2014).

This occupation is characterized by high psychic and emotional tension and heavy load on sensor systems (eyesight, hearing). These conditions set serious requirements to psychological characteristics of an operator, in particular, to their psychoemotional stability and nervous system type, that were investigated in the present study.

LITERATURE REVIEW

2.1. Psychoemotional stability in the aspect of professional occupation

Psychoemotional stability (emotional-volitional stability, psychological stability) is often studied in such spheres as pedagogical activities (Baitukbaeva, 2014), welfare activities (Kazakhova, 2008), emergency service (Morozova and Kuflina, 2015), law enforcement activities (Fisher, 2014; Valeeva and Khairullova, 2013), power supply service (Gavrysch *et al.*, 2008), aviation, i.e. those types of human activities that are associated with human-related or equipment-related stress situations. Operator activity can be classified as socio-technical, because it is based on technological process handling and involves social interaction with the workshop colleagues. GFCP operator activity can be seen as operator-supervisor, operator-performer, operator-technologist, etc. Within each of these roles, an operator has to demonstrate psychoemotional stability and concentration on the object of labor under different distracting conditions.

Psychoemotional stability is defined as an integral personality characteristic that provides its resistance to frustrating and stress-producing factors, i.e. ability to maintain optimal mental

functioning under changing conditions or under stress. This personal attribute is not inherited genetically, but develops together with personality formation. Personality behaviour, characterized by high level of psychoemotional stability, follows a specific algorithm: objective setting, motive actualization and objective realization. Further, an individual understands the difficulties that arise during objective realization, which provokes negative emotional response. After that, an individual looks for ways to overcome these difficulties, which, in its turn, leads to reduction of negative emotions and improvement of performance efficiency.

In cases when a personality is characterized by psychoemotional instability, a different algorithm of behaviour is observed: difficulties provoke negative emotional response that leads to chaotic search for solutions and, as a result, to intensification of negative emotions, worsening of performance and drop of motivation.

Difficult situations can be excluded neither from professional activity, nor from life in general. Any professional has to be ready to face them. However, it is important to set the tasks that meet operators capabilities and to work at the improvement of their psychoemotional stability. This issue requires understanding of this psychic phenomenon nature and character.

A number of researchers believe that inadequate and psychoemotional status is the main reason for wrong judgement at making decisions. Emotional instability in humans can often lead to fatal human errors. Overexcitement and surge of emotion are associated with the feelings towards the situation and expectation of possible uncorrectable results of their wrong solutions, which, in its turn, increases the risk of errors. Thus, psychological tension, caused by a number of circumstances associated with professional activity, leads to hastiness or slowness of reactions, which is unacceptable at equipment failure or suddenly changing situation (Mamaev *et al.*, 2017).

It should be noted that psychoemotional stability (emotional-volitional stability, psychological stability) is an obligatory criterion of professional and psychological selection of the applicants for operator position (Kuzmenko, 2013).

It is known that high level of psychoemotional stability of a professional provides capability of adequate analysis of conditions, planning and

performance, which relatively levels the influence of external and internal conditions on the specialist performance efficiency. H. Bless and J.P. Forgas proved that such abilities were connected not only with psychoemotional stability, but also with the specialist age and level of qualification (Bless and Forgas, 2011). It can be suggested that psychoemotional stability is formed within the lifetime and labor activity. Thus, if a specialist professional activity is associated with techniques and skills formation, that are defined as psychological regulatory capabilities, in particular, adequate professional situations handling, forecasting, planning and ability to be flexible, a specialist psychoemotional stability will increase along with the mentioned skills improvement. In this case, the described psychological phenomenon can be associated with a specialist professional success.

2.2. Nervous system type in the aspect of professional activity

It should be mentioned that psychoemotional stability depends on the type of nervous system (which is an inborn attribute), person's life experience, skills, level of professional training, social interaction skills, type of activity, etc. According to L.M. Abolin, external conditions of emotional stability-instability include emotional-physiological reactivity, nervous system properties and acquired during lifetime emotional qualities (Abolin, 1987). The issue on mutual influence of nervous system and emotional stability were investigated also by K.M. Gurevich (Gurevich, 1970). In this case, the authors are interested in one of the main factors that influence on operator activity – weakness or strength of nervous system and its interconnection with psychoemotional stability in the aspect of GFOP operator profession.

Nervous system attributes are crucial for many different professionals, including operators. V.F. Matveev, in his description of operators-managers of power supply systems, mentions that “operator's qualities”, that enable specialists deal with their work in emergency situations, are more expressed in people with strong nervous system. People with weak nervous system proved to be unsuccessful. They demonstrated perplexity close to shock, which led to increased amount of inadequate decisions and errors.

Psychological tension can be caused by different reasons in numerous professional

activities (adjusting engineers with weak nervous system sweat during equipment downtime, they get disorganized by master's shouting) (Matveev, 1966). Public transport drivers constantly face emergency situations as a background. The studies performed by V.A. Troshikhina, S.I. Moldavskaya and I.V. Kolchenko showed that after five-year professional experience, the highest reliability was shown by the drivers with high flexibility of nervous system and strong nervous system. The drivers, who have highly inert nervous processes, are careful and comparatively rarer break traffic rules, but still they get into traffic accidents more often. The mostly reliable drivers are those who have strong nervous system and average degree of nervous processes flexibility (Troshikhin *et al.*, 1978).

The studies on the rate of different car accidents, conducted by S.A. Gaponova, showed that there were equal amounts of drivers in both groups (accident-free group and accidents group). The author explained this by the fact that drivers from the first group were characterized by such qualities as emotional stability, interference stability, concentration and attention switch; and the second group was characterized by high capability of probabilistic forecasting, nervous processes flexibility, high throughput capacity of visual sensory system, long-term (Gaponova, 1983). There are publications on fire-fighters successful performance under extreme conditions that is associated with tendency towards risk-taking. It is mentioned that it is mostly expressed in patients with strong nervous system.

The study of typological peculiarities in radio telegraphist and telephone operator specialists, conducted by V.A. Troshikhin *et al.*, showed that the specialists with high flexibility of nervous processes and strong nervous system the most successful in profession acquiring. People with inert nervous processes and weak nervous system are not suitable for these professions (Troshikhin *et al.*, 1978). V. G. Zakharin contributed to the investigation of this issue and indicated on the fact that massaging rate of radio telegraphists depended on the degree of nervous system lability. "Specific difficulty for inert specialists is the demand to make quick repeated hand movements" (Zakharin, 1976).

N. A. Besstrashnaya studied typological peculiarities of typewriter successful performance. According to the author, this

profession requires abilities to coordinate quick movements, endurance for continuous quick typing and fast attention switch from one object to another. It was revealed that "people who successfully trained for this profession had high flexibility of nervous processes and high performance efficiency in tapping test" (Besstraschnaya, 1982; Ilyina, 2001).

Nervous system strength and emotional stability, as well as the reaction to a moving object, readiness for risk-taking is seen as a factor of young drivers reliability (Ljdokova *et al.*, 2014).

The described examples show that people with strong nervous system and high psychoemotional stability are more successful in coping with extreme situations as compared to people who do not demonstrate these abilities. Weak nervous system is characterized by low stability to continuous neuropsychic impact on psychic and can be taken as a contraindication to operator (Sarychev, 2009).

The authors defined the criteria of GFCP operator professional successfulness. They included personal attributes that depend on inborn and acquired psychophysical peculiarities, for example, qualities that are important for operator successful performance. Based on the peculiarities of glass fiber continuous two-stage technological processes, GFCP operator should possess the following personal and psychophysiological characteristics: quick attention switch, stress stability, concentration, tendency to monotonia, positive attitude to repetitive work, high movement coordination, high reaction rate, good adaptive capabilities, psychoemotional stability, communication skills, vast volume of operational memory, absolute performance accurateness, quick information processing, movements rate, strong type of nervous system, tendency towards physical labor, high working capacity, personal responsibility in technological system handling, positive professional inner motivation and satisfaction with the labor. The ranging of these characteristics by the plants specialists (masters, senior masters, technologists, labor specialists, HR specialists) showed that psychoemotional stability and strength of nervous system were among the five most important characteristics (Makarova *et al.*, 2016).

METHODOLOGICAL FRAMEWORK:

The study of nervous system interconnection with psychoemotional stability depending on the professional successfulness included 64 GFCEP operators. The group of respondents consisted of employees of "P-D Tatneft-Alabuga Steklovolokno, Llc" aged from 22 to 43 years old. The respondents were males only due to peculiarities of this occupation. 10% of the respondents had general secondary education, the majority (56 %) of the respondents had specialized secondary education and 34% had higher education. Labour experience of the employees varied from 7 month to 8 years.

According to the objectives of the empirical studies, two groups of operators were formed. The first sampling included the operators that were relatively "more successful", i.e. had better professional performance and better productivity parameters according to the operators self-evaluation. Questionnaire on GFCEP operator successful performance evaluation, developed based on the analysis of production documentation and masters advice, was used. The conducted survey included such parameters as out-turn, operating time, operator performance accuracy and bonus payments. Thus, the sampling of "more successful" operators included 32 respondents aged from 24 to 39.

The second sampling included "less successful" operators that had lower parameters of professional performance as compared to the first sampling. This sampling also included 32 operators aged from 22 to 43. Operators from each group were tested by E.P. Ilyin "Tapping test" in Y.A. Tsigarelli modification and the method of psychoemotional stability diagnostics ("Activatiometr AT-9K").

RESULTS AND DISCUSSION:

Express-diagnostics of psychoemotional stability included observation at the operators reactions to real or imitated stressor in modelled situations. The software registered the parameters of psychoemotional stability at the moment of maximal stressor influence on the testees. Further, the parameters of stress-induced and background psychoemotional state were compared and the diagnosis was made based on the difference. The summed results on psychoemotional stability in GFCEP operators are presented in Table 1.

The results of psychoemotional stability diagnostics showed that low and below average parameter values were not presented in operators samplings, average values were registered only in 6% of "less successful" operators. Only 6% of operators had perfect psychoemotional stability in this group, and the majority of testees (88%) had high level of psychoemotional stability. In the sampling of "more successful" operators the parameter values distributed between perfect or very high (53%) and high (47%) levels of psychoemotional stability. It should be mentioned that in the first sampling the parameter values were higher than in the second sampling. The results indicate on the importance of stress stability to psychological stresses and physical overloads in operator occupation. That is why, low values were not revealed among the testees. However, the majority of more successful operators had perfect psychoemotional stability.

The next stage of the study included qualitative and quantitative analysis of the testees results on strength or weakness of nervous system diagnostics, obtained by the instrumental variant of E.P. Ilyin "Tapping test" in modification of Y.A. Tsigarelli ("Activatiometr AT-9K"). Results distribution of the parameter values in "more" or "less" successful operators.

As it can be seen from Table 2, the strength of nervous system was better in "more successful" operators (21%) than in "less successful" operators (9%), and weakness of nervous system, in its turn, was more expressed in "less successful" operators (81%). Strong nervous system was one of the most important requirements in operator occupation. Naturally, those operators, that have stronger nervous system, are more successful in their work performance.

The conducted study allowed to establish the interrelation between psychoemotional stability and nervous system type in GFCEP operators, which is confirmed by the results, obtained by other researchers in their studies on a number of technical professions. Pearson correlation coefficient between the studied parameters of "more successful" operators was 0.8, which indicates on very close correlation between the level of psychoemotional stability and strength or weakness of nervous system. This correlation was statistically significant at $p \leq 0.01$. Thus, stronger nervous system in "more successful" operators correlated with higher

psychoemotional stability and vice versa. Both characteristics allow operators to tolerate high physical and psychological loads and maintain “sober mind”, i.e. act flawlessly and make decisions instantly under changing conditions.

In the group of “less successful” operators Pearson correlation coefficient was 0.6, which indicates on very close correlation between the level of psychoemotional stability and strength or weakness of nervous system. This correlation was statistically significant at $p \leq 0.01$. Thus, “less successful” operators had weaker nervous system and low psychoemotional stability.

It should be mentioned that there were some differences between operators groups. Mathematical analysis of the obtained data on psychoemotional stability by Mann–Whitney U test showed that Uemp coefficient was 172, which indicated on statistically significant difference at $p \leq 0.01$. Respectively, in the group of “more successful” operators the parameters of stability to emotiogenic stressors were better, so these operators tolerated different emotional loads easier. In the group of “less successful” operators the level of psychoemotional stability was lower. Insufficient level of mental flexibility at tasks switching was observed. An increased risk of somatic diseases development is probable, because such individuals are more stress prone. Such employees have to change their attitude to the surrounding situation. Probably, negative emotions slowed down professional productivity in the studied group.

Mathematical analysis of the obtained data on nervous system type showed that Uemp coefficient was 361.5, i.e. there were differences in nervous system type ($p \leq 0.05$). Thus, nervous system parameters were better in “more successful” operators, i.e. they were characterized by higher level of stability, better working capability and tolerance to different distractions. “Less successful” operators were characterized by low working capability of nervous cells that quickly wears out. Because of small reserve of energy and increased fatigability, such operators become less resistant to monotonia and professional stress, which can complicate their success in operators occupation.

CONCLUSIONS:

The conducted empirical study results showed that high psychoemotional stability and strong nervous system were very important in the

aspect of GFCP operator professional performance. It should be noted that there was close correlation between the studied parameters regardless of the operator successfulness level. High psychoemotional stability and strong nervous system are defined as psychophysiological characteristics that are necessary for operator occupation. The obtained results indicate on higher expression of these characteristics in “more successful” GFCP operators than in “less successful” operators. Thus, psychoemotional stability and strength of nervous system can be considered as necessary psychological conditions for successful operator professional performance.

Operators are influenced by stress, overloads, inner tension, over fatigue and labor monotony. Negative impact of such factors can influence on the level of psychosomatic health. The results of the study defined psychological requisites of successful operator professional performance that could be used at professional and psychological staff selection. It should be noted that some characteristics of human psychic can adapt to unfavorable factors, significantly increasing psychoemotional stability, which proves that this capability can be developed. Probably, “more successful” operators, that also had longer work experience in the respective conditions, managed to raise the level of their stability to these conditions.

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Table 1. The results of psychoemotional stability diagnostics in GFCEP operators

Psychoemotional stability evaluation	"More successful" operators	"Less successful" operators
Perfect	17 (53 %)	2 (6%)
High	15 (47%)	28 (88%)
Average	0 (0%)	2 (6%)
Below average	0 (0%)	0 (0%)
Low	0 (0%)	0 (0%)

Table 2. Strength or weakness of nervous system diagnostics in GFCEP operators

Diagnosed parameters	Degree of parameter expression	"More successful" operators	"Less successful" operators
Nervous system strength	Low expression	1 (3%)	3 (9%)
	High expression	1 (3%)	0 (0%)
	Very high expression	6 (19%)	0 (0%)
Average nervous system		5(16%)	3 (9%)
Nervous system weakness	Low expression	9 (28%)	0 (0%)
	Average expression	6 (19%)	7 (22%)
	High expression	3 (9%)	11 (34%)
	Very high expression	1 (3%)	8 (25%)