Methods and techniques for controlling knowledge acquired at instructional briefings while occupational safety training

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Abstract: The article is devoted to the analysis of control procedure organization as the final stage of labor protection educational process when studying the causes and prevention of injuries. In the course of the control procedures analysis, traditional and innovative methods of control have been identified and put into practice, considering the aspect of their effectiveness and efficiency. An examination of the methods of controlling knowledge mastering, as a result of safety briefings on avoiding industrial injuries, has been carried out. The potential of different methods of control has been revealed. It is assumed that the use of interactive methods and innovative forms of control increases the effectiveness of labor protection instructions, since besides the controlling function, they have the training potential.

1. Introduction
The organization of a labor protection training process in the area of preventing occupational injuries is an extremely important and responsible process, since the life and health of the employees often depends on it. Therefore, the process of controlling the knowledge gained in the learning process becomes fundamentally significant. It is this fact that determines the main problem of the article: which control methods are most correctly used as a result of training, so that they objectively evaluate the acquired knowledge and at the same time allow to implement the training function of control methods.

Analytical approach to accounting for reported and unreported cases of injuries predetermines a special view on the state of activities on the organization of safety briefings and subsequent evaluation of the effectiveness of acquired awareness, competence and skills. The definition of injury cases today gains a considerable escalation importance for the employers responsible for accidents involving a traumatic outcome. Thus, the qualification of a case of injury occurred at a production facility, requires the timely organization of cognitive adjustment of a safe professional human activity as a unit, which ensures the reliability of the system at the place of implementation of one’s work duties [1].

The process of taking into account all factors influencing the state and behavior of a person in conditions of increased injury risk is quite complex and entails various consequences that are not always commensurate with working conditions, the potential of the human factor in different systems, reliability, reflecting the reality of high-risk environments and etc.

In this regard, a safety instructional briefing becomes one of the main activities, including the available forms and methods of modern prevention of trauma, as well as the elimination of possible
causes and conditions for the manifestation of injuries in the environment of human production activity [9].

2. Methodology of research

In the course of this study, the following methods were applied: analysis of occupational safety and health education experience, observation, analysis of related studies, experimental training, survey among safety instructors.

Based on the recommendations of the GOST state standard on the arrangement of occupational safety education, “training in occupational safety must have a continuous multi-level nature and is to be carried out in all organizations, among all employers, in educational foundations and institutions, as well as while improving knowledge of occupational safety requirements in the course of work” [3].

To implement this provision in practice, it is possible to use a variety of structural methodical forms, approaches, technologies and methods of training arrangement in occupational safety.

Conceptually built learning process assumes the variability and diversity of its practical execution, which allows the teacher to use both traditional and innovative teaching methods and knowledge control, the latter of these look preferable because they allow to carry out training at a modern level, ensuring the assimilation of knowledge at all stages of pedagogical process.

The GOST state standard recommends the use of classroom lessons for training in occupational safety: lectures, seminars, practical and laboratory work, briefings, internships and various modifications of computer-based training, including distance learning [3].

Instruction and follow-up activity to assess the effective learning of prevention and avoidance of traumatic cases is a problem of sufficiently high scientific relevance, the importance of which increases along with a steady growth in ensuring the competitiveness of a working person, as well as an enterprise on the whole.

Thus, the methods of conducting classes and briefings are covered in the studies of E. L. Danilevsky [2], T. V. Galanina, K. D. Blok [4], and others.

The types of instruction arrangements and knowledge testing are given attention to in the works of N. V. Goncharov [5].

The factors ensuring injury prevention at the workplace in the framework of instruction and cognitive correction are addressed in the works of V. I. Kozlov, N. V. Povednyuk [6] and Megan Ray Nichols [7].

3. Results

As a result of this study, general pedagogical methods of control were adapted for use during training in labor protection, which allowed expanding the range of methods used and improving the effectiveness of monitoring the results of the process of labor protection training.

The analytical review of the studies by leading experts in the field of instruction methods on preventing traumatic cases showed both the effectiveness of statistical analysis, based on the model of biological failures due to an injury, and the potency of developing methods and finding ways to test knowledge after conducting a safety briefing.

Evaluation of failure parameters in cases of traumatic consequences based on factors of disease, overwork, violation of labor can be described by the following equations.

In the failure model, the effectiveness of injury prevention can be predicted based on the following approaches in estimating the increment of failure parameters (1).

\[ N = \frac{t - 8}{1000000} \]

where \( N \) – quantity of human errors in the labor process; \( t \) – work duration, hours.

On the contrary, the model of failure prevention will be almost entirely based on the methodology of testing awareness, competence and skills after the briefing (2).
When \( FO \) – type of failures associated with overworking of a person in the labor process, probability of absence of biological failures (reliability of the human factor) can be estimated by the formula.

\[
R = e^{-(FI + FO)t}
\]

where \( R \) – reliability of the human factor; \( e \) - base of the natural logarithm; \( FI \) - quantity of failures due to illness; \( FO \) - quantity of failures due to overworking; \( t \) – work duration, hours.

Testing knowledge of instruction can be carried out both with the involvement of traditional and with the use of innovative methods and techniques.

The following ones can be considered traditional:

- **test-fixing** the message of the instruction with the use of the instructor’s guiding function; thanks to this cognitive approach, the principle of didactic formalism is implemented, which ensures the strength of learning based on repetition; as a rule, the main methodological techniques in this method include repeated displays, the use of instructional cards (instructional cards allow you to track the correctness and sequence of actions performed in an exercise), the analysis of typical errors, etc.;

- **test-training**, providing an analysis of the degree of knowledge of instruction in conditions close to real; within the framework of this method, the verification of the exercise is performed as it should be in any process (production, training, socially constructed, etc.); within the framework of the method, the techniques of performing the exercises are used in stages, in detail, by piecemeal, holistically, and also in the time limit that requires practicing the skills and abilities to perform exercises without error;

- **fixing-re-creation**, the methodological toolkit of which is implemented almost immediately after the briefing and reflects a random access memory specifics of instructed employees; fixing-re-creation involves testing practical knowledge as well as the ability of subjects to master the rules of workplace organizing, work process, calculations, and other related activities;

- **target inspection**, which allows to determine how well the instruction material has been learned and how well an instructed person follows it.

In the spectrum of traditional approaches to the knowledge verification of instruction, there is a sufficient number of methodological means and techniques that, under various conditions, can act as both a method and an instrument of knowledge verification.

In modern conditions, when injuries are becoming quite frequent and require more careful approach to their prevention, the popularity of innovative methodological solutions to test awareness, competence and skills to master an occupational safety instruction increases even further.

Among the innovations, a special potential in the aspect of teaching occupational safety is possessed by a group of methods, which are commonly called interactive. They are classified as follows: game methods (business, imitation and didactic games), discussion methods (case study, brainstorming, group discussion), individual methods (solving practical problems).

It should be noted that the use of interactive methods expands the learning capabilities of all stages of an educational process, allowing to control occupational safety knowledge at any stage of training and provide instruction in an innovative form at the same time.

A teacher performing his individual approach to the process of occupational safety tuition can combine interactive teaching methods with innovative forms of knowledge control.

These innovative forms include:

- **method of imitation**, in the frame of which happens a re-creation of dangerous situations, where cases of injury are possible and the skills of instructed actions are worked out;

- **method of virtualization**, in which virtual conditions of danger are re-created; in the framework of this method, the means and techniques of information technology are involved;

- **method of cognitive correction**, which is resorted to when anomalies of behavior occur in the process of a dysfunctional experience formation; within the confines of this method, as a rule, special techniques are used to restore a rational understanding of reality conditions, as well as those aimed to eliminate cognitive errors based on optimizing of the system of constructs;
• method of professional skills assessment (PSA), those are demanded while mastering the material of the safety briefing, using the methods defining the PSA, evaluating the PSA by importance for preventing injuries, ranking the PSA and identifying the degree of formation according to the briefing requirements.

4. Discussion
Perhaps a longer experiment is needed to be able to compare the effectiveness of using traditional and innovative methods for assessing learning outcomes.

5. Conclusion
According to a survey conducted among occupational safety instructors at the Advanced Training Faculty of Izhevsk State Technical University, the combination of active and interactive teaching methods significantly increases the effectiveness of an occupational safety training [8].

In the process of testing an instructional knowledge, it is also possible to use active and interactive methods and techniques, the availability of which at the present stage of development provides greater opportunities to prevent injuries in the context of various types of professional, educational and other activities.

This article addresses only some aspects of the use of control methods as the final stage of instruction on injury prevention. The spectrum of the methods used can be expanded, the forms and methods of control are modified in the direction of further revealing their learning function.

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