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Methodology of Education of Specialists in Industrial Enterprises using for Site Technology on the Effect of Electricity on the Human Body

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Annotation: *The article provides important information about the role of electricity in the development of industries, the need for electricity in Uzbekistan, alternative energy sources. Accidents under the influence of electricity are analyzed, a classification of factors determining the impact of electric current on the human body is developed. As an innovative pedagogical technology for training specialists in electrical safety in industrial enterprises, the classification of foresight technology methods and the analysis of foresight research are presented. A methodology for using foresight methods in teaching has been developed and is based on examples.*

Keywords: *electricity, alternative energy sources, innovative technology, foresight, research, foresight methods.*

INTRODUCTION

Mankind is living in the information age. Innovative devices, smartphones and various gadgets are emerging as the driving force of modern civilization. This means that electricity will continue to be produced at an increasingly rapid pace and will become an integral part of our daily lives. No matter how important electricity is in everyday life, it cannot be compared to its place in the economic life of the country. It is not in vain that electricity is like blood flowing in the veins of the economy. Its importance for industry, business and any business activity is incomparable.

The economy of our country is developing rapidly, and the share of industry in its structure is growing. The living standards of the population are growing and the use of electrical appliances is increasing. In particular, over the past 5 years, the number of entrepreneurs consuming electricity has increased by 25 percent, and their consumption has increased by 30 percent. Therefore, we have set very big plans for the implementation of new reforms and projects in the electricity sector. In particular, over the next 5 years, an additional 11,500 megawatts of new capacity will be launched at the expense of 19 projects worth $ 6.5 billion. By 2030, the share of renewable sources in the structure of electricity generation will exceed 30%. 3,000 kilometers of new 500 and 220 kilovolt power lines will be built to transmit electricity to the regions. At the same time, today 66% of low-voltage networks, 74% of substations and more than 50% of transformer substations are obsolete. Therefore, over the next five years, a total of 70,000 kilometers of low-voltage power lines, 22,000 transformers and more than 100 substations will be upgraded.

On the eve of the 30th anniversary of independence of our country, the first solar photovoltaic station in the country was launched in Karmana district of Navoi region. It produces 252 million kilowatt-hours of electricity per year. This will save 80 million cubic meters of natural gas and prevent the release of 160,000 tons of evaporative gases into the atmosphere. Currently, 6 energy projects worth 1,700 megawatts worth about $ 1.5 billion are being implemented in Uzbekistan. In particular, a 500-megawatt wind farm and a 200-megawatt solar station with the participation of Fanes Group will be built in Navoi region in 2023 in cooperation with Masdar.

Uzbekistan's demand for electricity today is 69 billion kWh. Almost 85 percent of it comes from natural gas and coal-fired thermal power plants, and 15 percent from hydroelectric power plants. 16.5 billion cubic meters of natural gas, 86,000 tons of fuel oil and 2.3 million tons of coal will be used to generate electricity. Along with the growing population, the demand for electricity is also growing. Therefore, the construction of nuclear power plants in Uzbekistan is the only way to reduce the share of hydrocarbons in the energy balance. The use of solar and wind energy cannot adequately support the evolving and rapidly growing production. Uzbekistan is the world's ninth largest uranium producer. This will allow it to easily supply nuclear fuel from the start of the NPP.

In short, in this century, human life cannot be imagined without electricity. However, electricity not only facilitates human labor and creates many conveniences, but is also dangerous for human life and health [2]. Analysis of static data on industrial injuries shows that electric current injuries account for an average of 1 ... 1.5 percent of total industrial injuries. However, it has been found that 30 ... 40 percent of all fatal accidents at work are caused by electric shocks. These data confirm that electricity is one of the most dangerous factors in human production. Therefore, the issue of electrical safety is very important in all areas of human activity, including manufacturing.

MAIN PART

The Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030 provides for the use of digital and innovative pedagogical technologies in the education system, including Forsyth technologies. At present, in order to organize the introduction of foresight technologies in sectors of the economy, including higher education, a draft Resolution of the President of the Republic of Uzbekistan "On the establishment of foresight centers in leading higher education institutions of the Republic of Uzbekistan" ID-3800 has been developed and discussed.

Foresight is a relatively new term. The practice of developing long-term strategic plans, concepts and long-term road maps in the economic sectors of Uzbekistan, including education, on the basis of this technology has not been established. No methodology or recommendations have been developed for the use of foresight methods in the higher education system learning process.

Foresight means active forecasting of the future, the creation of a sound strategy for the future development of the economy, science, business and other areas through vision. A long-term (5 to 30 years) development program or concept of foresight-based development is based on short-term evidence-based data, i.e., a future strategy is planned based on clear, high-level evidence [3].

The purpose of the foresight is to identify strategic research and innovative technologies aimed at high profitability, that is, to identify a highly profitable future and create a strategy to achieve it.

RESEARCH METHODS

Forsyth projects are not direct predictions of this. Several methods are used in the implementation of foresight projects. For example, in Japan, the Delphi method is used, while in Germany and the United Kingdom, a combination of several methods is used, while in the United States and France, there are experiments to identify critical technologies [4].

There are currently more than 30 methods of foresight research and they can be divided into the following 3 groups: [5]

1. Methods of quality assessment: retronolation, brainstorming, civic panel, conferences and seminars, essay (screenplay), expert panel, prediction, interview, literature analysis, morphological analysis, goal tree (logic scheme), role-playing games, script, reverse scenario, science fiction, simulation games, verification, SWOT-analysis, weak signals (jokers);
2. Methods of quantitative assessment: benchmarking, bibliometry, indicators (analysis of time series), modeling, patent analysis, extrapolation of traditions (spreading or applying the results of observation of one part of an object or event to another part of it) [6].
3. Mixed methods: structural analysis, dolphin, basic perspective (critical) technologies, resource interpretation, global trends analysis, numerical scenario creation, roadmap, stakeholder opinion analysis, interaction analysis, resource scanning, testing, future forecasting, games, global trend analysis, modeling, simulation, multicritical analysis, future box, and more. This initial study used brainstorming, scriptwriting, and expert panel methods [7].

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FORSIGHT RESEARCH ANALYSIS

Since the 1990s, foresight technologies have been widely used in the United States, Europe, Asia, and Latin America to determine the long-term prospects. Based on the results of the foresight projects, large-scale international research programs have been developed, including the budget expenditures of the EU's Sixth and Seventh Research and Technology Development Program at 17.5 and 54 billion euros, respectively. euro. Sweden's latest foresight project cost 3.6 million euros, while Turkey spent about 2 million euros. Based on an analysis of reports by Alexander Sokolov, Director of the International Foresight Center of the Higher School of Economics (Russia), foresight technology was used 50 years ago in the US RAND Corporation to identify promising challenges for military technology. By the 1950s, when RAND experts developed the Delphi method after meeting the shortcomings of traditional methods of determining future technologies. This method is now widely used in foresight research in all fields. Since the 1970s, foresight technologies have also been used in the development of national-level strategies. In the socio-economic field, foresight technology was first used to identify the most promising areas of science in the late 60s and early 70s. By the late 1960s, technological forecasting was accepted in Japan as a potentially useful political mechanism, and the U.S. experience in this regard had been extensively studied by experts. In 1970, the Japan Science and Technology Agency (STA) developed a 30-year long-term forecasting strategy for science and technology development and ways to achieve it.

Today, foresight projects are used as a key technology in creating future strategies in all developed countries. The research conducted by research and forecasting teams in Europe, the United States, and Southeast Asia is aimed at creating technological systems and methodologies that enable tracking of technological trends, creating opportunities for new research and development. Therefore, historically in the United States, this activity has been carried out by RAND Sogrogation (visual Researchand Development) and other transnational corporations. Universities are actively involved in data collection, the creation of special portals and systems, focusing on the technical aspects of forecasting based on European educational programs, in the assessment of future performance in Europe. The University of Manchester (UK) is an example of the creation of a foresight system and the prediction of scientific and technical directions. Another university based on the results of Forsyth research is Sigularity University, which was founded by the American Aerospace Research Agency (NASA) in partnership with multinational corporations such as Soogle, E-rlapet Ventures, Autodesk, Sisco, the Kauffman Foundation and Nokia. Russian higher education institutions have begun to play an important role in the system of identification and forecasting of the main directions of scientific and technological development of the country. In 2011, a regional network for forecasting scientific and technological development was established jointly with 6 prestigious universities. The activities of these networks include the establishment and maintenance of regular contacts of experts in education, research, government and the business community [9].

RESEARCH RESULTS AND DISCUSSIONS

The use of foresight methods in the teaching of occupational safety also gives good results. Good results can be achieved in improving working conditions by predicting accidents, identifying the causes of accidents, strategic plans for the effective organization and improvement of labor protection, the use of foresight methods in the development of road maps.

The authors have developed a teaching method on "The effect of electric current on the human body and ways to protect against it" using Forsyth methods.

In the first phase of the training, Forsyth's brainstorming, scripting and expert questioning methods were used and carried out in 3 phases.

In the first stage, students are divided into 2 subgroups, and the classification of factors determining the effect of electric current on the human body was formed using the method of "mental attack". The first group creates a classification of factors related to electrical current indicators, and the second group creates a classification of factors related to the human body. In this style, the focus was not on quality, but on quantity, i.e., how many factors were to be collected. Freedom of expression and non-evaluation of results led to the formation of different opinions among group members. Which group determines the most factors is used as a criterion in winning between small groups. As a result, a classification of more than 10 factors was created.

Classification of the main factors determining the effect of electric current on the human body

№		
1	1. Factors related to electric current indicators	1. Current type (constant, variable) 2. Current strength 3. Voltage 4. Current phase 5. Current frequency
2	2. Personal qualities of a person and factors related to the effect of current on him Factors Name Negative Impact	1. Resistance of the human body to electric current: - wet or dry human skin; - rough or soft skin; - a person's mental state 2. The path of electric current through the human body 3. Time under current 4. The surface of the human body exposed to current

In the second stage, the small group leader justifies the effect of each factor, which one member of the group fills out if he or she cannot justify the factor.

In the third stage, the scenario method was used. In most cases, several alternative models are created. Non-standard solutions to the problems that are likely to arise are sought through the development and improvement of alternative projects. The relative advantages of different alternative solutions were determined using a factor rating or evaluation.

The low level of probability of exposure to electric current is assessed by the proximity of the time of occurrence of decomposition factors.

During the training, the following 2 different alternatives of situations that could be affected by electric current were developed.

I OPTION:

Organizational reasons:

- workers are not trained in electrical safety;
- untimely delivery of instructions;
- Lack of personal protective equipment for workers;
- unsatisfactory control of electrical equipment by engineers and technicians;
- poor quality of preventive maintenance of electrical equipment;

- Lack of rules and instructions for working with electrical appliances and equipment in the workplace.

OPTION II.

Technical reasons:

- Lack of reliable barriers in live parts;
- Improper installation of electrical appliances, equipment and conductors;
- Failure to take into account the categories of electrical safety of buildings in the installation of electrical equipment;
- Lack of protection and storage facilities;
- Improper installation of protection and storage devices.

At the end of the training, under the guidance of the teacher, it will be determined for what reasons the probability of many accidents in production.

CONCLUSION

The training of specialists in occupational safety in industrial enterprises requires the use of modern innovative pedagogical [10] and digital technologies in accordance with modern requirements. Especially in training courses, lectures need to be organized in the form of modern lectures [11] using interactive methods and extensive use of e-learning resources [12,13]. The use of the project method [14], aimed at the development of scientific and creative activity, gives good results, especially in practical training. At the same time, the participants of the training course can form projects on measures to improve occupational safety in various variants.

Forsyth is a technology that is just entering the learning process, and a perfect definition has not yet been created. The use of foresight in occupational safety training courses provides an opportunity to predict accidents. This is consistent with the aposterior method of accident analysis. It is in this style that accidents and causes are analyzed before accidents occur. If this method is based on foresight technology, the result will be more effective and accidents will be prevented. On the basis of foresight, long-term strategic plans or roadmaps for improving labor protection in enterprises can be developed.

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