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OCCUPATIONAL SAFETY MANAGEMENT THROUGH TRAINING IN THE STEEL INDUSTRY

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Purpose: Managing the areas of occupational health and safety is a complex topic and requires a lot of knowledge from the management staff in relation to management sciences. The issue of human factor management is based on human behavioral factors. It refers to the psychological aspect of a given individual and often requires adjusting the way of expression and content to the level of the recipient of a given training. Therefore, the person conducting the training should have a large amount of knowledge and have many tools to both increase the effectiveness of the training and its verification can be done using various methods such as: tests (Kojnoková et al., 2023).
Design/methodology/approach It contained fifteen questions (the first five related to the metrics of respondents, the next five questions related to training in the field of occupational health and safety, the last five questions referred to the impact of training on the level of safety) ranks of factors according to the Likert scale has been presented. The part of research was the introduction of data into the enclosure sheet and the determination of mutual correlations using the correlation function.
Findings: The research showed a large relationship between the frequency of training and the level of safety among respondents. In addition, studies have shown that training conducted using methods that activate employees increases their effectiveness.
Originality/value: The article shows the forms of matching training in the field of occupational health and safety in steel plants. Due to the high risk occurring in the areas of steel mills, training plays a key role in the safety of employees. The content of the article is addressed both to academics who can obtain information on increasing the effectiveness of training in the areas of steel mills and to people training metallurgists to transfer knowledge as effectively as possible.

Keywords: safety, training, steel industry.

Category of the paper: Research paper, case study.

1. Introduction

Managing the areas of occupational health and safety is a complex topic and requires a lot of knowledge from the management staff in relation to management sciences. The issue of human factor management is based on human behavioral factors (Wolniak, 2013). It refers to the psychological aspect of a given individual and very often requires adjusting the way of expression and content to the level of the recipient of a given training. Therefore, the person conducting the training should have a large amount of knowledge and have many tools to both increase the effectiveness of the training and its verification can be done using various methods such as: tests or quizzes (Furman, Małysa, 2023). Training as well as audits, inspections and monitoring of the work carried out have a very important impact on the formation of safety culture in entrepreneurs (Gajdzik, 2008; Chaib, 2014). Activities aimed at shaping a safety culture and promoting aimed at increasing work safety are very important aspect determining the reduction of accidents in enterprises (Chaib, Taleb, Benidir, Verzea, 2014). Promoting safety behaviour is a very important aspect conditioning the overall culture of occupational health and safety in a given company (Vranješ, Todić, 2019). These activities can be carried out using various tools and methods also during training in the field of occupational health and safety (Gembalska-Kwiecień, 2018; Elles, Villabona, Martelo, 2018). Training methods and tools needed for their implementation should be tailored to the recipients and the subject matter (Lee, F.H., Lee, T.Z., Wu, 2010; Lakra, 2016). Therefore, the main purpose of this article is to examine the important role of training in the field of occupational health and safety in the areas of steel plants. Determining mutual correlations regarding the form and frequency of training will allow to determine the optimal methods and tools needed to train steel plant employees. And content as well as findings can be interested to academics who can obtain information how to increase the training and to people training metallurgists to transfer knowledge as effectively as possible.

Teaching resources and their distribution

Didactic means are all materials of a material nature that increase the effectiveness of the education process. They are aimed at facilitating and increasing the effectiveness of learning. The following didactic means are distinguished:

- Didactic aids are all means that can be read directly, among others: maps, textbooks, models and photographs.
- Didactic materials are a group of measures requiring a specific technical measure. Materials can be transferred only in an indirect form, e.g.; through multimedia presentations.
- Technical means of education are all means that make it possible to read the content of materials prepared in advance. These include: projectors, computers and laptops.

- Pedagogical means of work is a group of measures thanks to which it is possible to perform certain activities in practice. These include: laboratory equipment, measuring instruments and other means of communication.

The selection of didactic means in relation to OSH training is variable depending on the subject and group of recipients (Einarsdóttir, Snorradóttir, 2020). These trainings are characterized by high variability, because they can apply to almost any type of work. This determines the trainer selection in terms of their knowledge and experience in a given industry (Panfil, 2013).

Forms of conducting training in the areas of occupational health and safety

The use of various training techniques is aimed at increasing the assimilation of a given material. A an example toutoring (in relation to science, which aims at a long period of time such where there is a student-master relationship) can be also used to convey simple educational content. However, it requires from the lecturer high flexibility and the ability to select materials and content to the needs of the recipient. The use of this method favors the individualization of the teaching process and gives the opportunity to shape attitudes (Saunders, Ron, et al., 2020). Another positive aspect is the ability to verify knowledge after each stage of teaching. Due to the master-student relationship, a bond is established where the learner gains a kind of mentor who can be a "model". Both this can be considered as a positive and negative aspect, because the student may have a distorted view of a given topic. Such a phenomenon occurs when an individual does not confront his knowledge with others and/or does not deepen his knowledge from other sources (Barnová, Krásna, Gabrhelová, 2019). This method is implemented by the "5 I" rule. It is determined by five instruments, each of which begins with the letter "i":

- Identification – to determine the needs of the students, determine their strengths and weaknesses.
- Individualization – to notice the individuality of participants by the lecturer and adapting didactic materials and methods to them.
- Intellectualization of the education process – to determine by the teacher the psychological profile and the intellectual type that of the students, which gives the opportunity to extract and stimulate to development.
- Integration - to combine didactic and practical means.
- Institutionalization - which results from the fact that this method is used in the areas of educational institutions, but recently it is increasingly used in companies.

Companies use this method of education in relation to the aspect of occupational health and safety. Regarding the law of the Republic of Poland, every employer is obliged to create a special unit for health and safety when it employs more than one hundred people. This is specified in the Regulation of the Council of Ministers of 2 September 1997 (on occupational health and safety services, Dz.U. 1997, No. 109, item 704). However, any economic operator, regardless of size, can employ an OSH unit, but this is a voluntary action. Such a practice is

aimed at increasing the organizational culture in the area of occupational health and safety in a given workplace (Mollo, Emuze, Smallwood, 2019). If the company has a permanent employee of the OSH service, it can use the toutoing method as a very good tool shaping good safe work habits. However, the toutoing method is well known as a long-term measure (Tracz, Rachwał, 2008; Rybina, Fontalina, 2020).

One of the most classic teaching methods is the giving method in the form of an information lecture. This method is used to convey information in a theoretical way. A characteristic feature of this method is the transfer of knowledge by the teacher, where the student (employee) plays rather a passive role. The role of the lecturer is to transfer knowledge in such a way that the recipient feels interested in the topic discussed. For this purpose, the teacher is required to start the class before the start of the class:

- Recognize the needs of the listeners.
- Prepare working materials.
- Prepare the structure of the training.
- Determine the level of understanding of the terminology used.

After the lecture begins, the lecturer should adapt the dynamics of the lecture to the audience. A very important aspect is that knowledge is transferred in an orderly manner. Other equally important factors determining the effectiveness of an information lecture are:

- maintaining eye contact with listeners,
- determining the positive after gaining knowledge,
- use of voice modulation,
- use of illustrative measures,
- taking care of the clarity of the message,
- summary of uploaded content.

The main advantage of the information lecture is the fact that it can be used in equal and variable conditions of training. Another advantage is the ability to transmit information in a large group. In the area of training, the advantages of this method should also be noted the possibility of conducting training in various industries. It can also encourage reflection of employees and inspire to deepen the presented topics. The disadvantage of this method is the low participation of participants, which in turn may lead to a decrease in the involvement of the subject matter. Therefore, special attention should be paid to the fact that the classes are conducted in a concise and logical way, in such a way that the recipient feels as much involved as possible in the subject matter (Mose, Reszka, 2010).

Another methods used in OSH training is "brainstorming", which is a loose form of conducting a discussion where each participant has the opportunity to speak freely. In this way, ideas are generated that can be saved to include any ideas and then the best ones are selected. Each participant of this form of training should be provided with the feeling that their statements are taken seriously. Therefore, there can be no situation in which an employee feels that his or her ideas are being discriminated against (Srihandayani, Marlina, 2019). This method distinguishes four successive phases:

- Containing an introduction to the subject of the discussion, theoretical explanations of the methodology itself, and setting rules during its conduct.
- Containing submission and reading of ideas. Participants in this phase also have the opportunity to ask questions to clarify the issue.
- Discussion of derived theses and ideas.
- Specifying the choice of a given solution, its justification, as well as determining its practical implementation. This phase is also designed to summarize the entire class and the subject matter taken up in it.

Brainstorming is one of the most creative methods of conducting training, because it encourages participants to have an open discussion and increases the creativity of employees. The openness of the lecturer to new ideas can give many unusual but accurate solutions to a given problem. A very important aspect of the whole method is the fact that it assumes the equality of each participant. Such an assumption has a positive effect on the freedom of expression of each group of the organizational structure of a given company. Thus, the most dominant entities cannot influence the group (Paulus, Kenworthy, 2019).

2. Methods and results

The main objective of the research was to determine how the selection of methods and means are most often used when conducting training by the occupational health and safety service and which of them are most often used by the introduction of training in steel plants. For this purpose, a research survey was developed in the form of a survey questionnaire. The questionnaire consisted of 15 questions. The first 5 questions referred to the respondents' metric which included questions such as: age of respondents, seniority, level of education and size of the town in terms of the number of inhabitants, in which they perform training in the field of occupational health and safety at the steelworks. The next 5 questions related to the manner and frequency of training.

1. Does your company provide periodic training (1 time per year)?
2. Do you change the method of conducting the training depending on the subject of the training?
3. Are the trainings conducted in your company conducted with the use of didactic materials in the form of: scripts, multimedia presentations?
4. Do you use elements that activate training participants during the training?
5. In your opinion, does the choice of the method of conducting OSH training affect the degree of understanding of the subject matter undertaken during the training?

The last 5 questions concerned the impact of training on safety.

1. In your opinion, does the increased frequency of training have a positive impact on the safety of employees?
2. Along with the increase in the frequency of training, do you observe an increased involvement of employees in shaping the OSH culture in your company?
3. After using methods activating training participants, do you observe an increase in the effectiveness of the training?
4. Does the presentation in a visual form increase the effectiveness of the training in your opinion?
5. In your opinion, does the involvement of the trainer in the training affect work safety throughout the company?

The respondents' answers were compiled using a five-point Likert scale (Suasapha, 2020), in which individual answers were given the following ranks:

- Yes, always - 5 points,
- Yes - 4 points,
- I don’t know - 3 points,
- No - 2 points,
- No, never - 1 point.

The tests were conducted from January 20, 2023 to February 20, 2023. The survey involved 60 respondents who declared conducting training in steel plants. The collected responses have been entered into a spreadsheet. Then, each of them was assigned ranks according to the five-point Likert scale. The next step was to develop a correlation function between individual questions and determine the most correlated questions to determine the relationships between individual questions. Results of the correlation is presented in Table 1.

Table 1.
Correlation distribution between individual survey questions

	Question 1	***Question 2***	***Question 3***	***Question 4***	***Question 5***	***Question 6***	***Question 7***	***Question 8***	***Question 9***	***Question 10***
Question 1	1									
Question 2	-0.159	1								
Question 3	0.333	0.863	1							
Question 4	-0.0417	0.985	0.918	1						
Question 5	0.992	-0.274	0.217	-0.160	1					
Question 6	0.352	0.835	0.996	0.902	0.237	1				
Question 7	0.974	-0.369	0.115	-0.260	0.995	0.134	1			
Question 8	0.993	-0.041	0.445	0.078	0.971	0.463	0.940	1		
Question 9	-0.066	0.957	0.912	0.979	-0.186	0.911	-0.286	0.057	1	
Question 10	0.137	0.941	0.979	0.975	0.016	0.971	-0.086	0.256	0.973	1

Source: Own elaboration.

When describing the correlation function, the following values were adopted:

- -1 very strong negative correlation,
- 0 no correlation between the examined features,
- 1 very strong correlation between the examined traits.

The relationship between the frequency of training and its impact on safety was investigated. Thus, only the last ten questions are considered for the correlation function. The study of the relationship between these questions was crucial for the whole article due to the subject matter undertaken. The study of the metrics was aimed at characterizing the studied community in terms of gender, education, seniority, and the size of the locality in terms of the number of towns in which they perform training in the field of occupational health and safety.

One of the strongest correlations occurs between question number one and question number seven and the correlation value is 0.975. Question number one concerned the frequency of training and periodic training (1 time per year). Question number seven concerned respondents' opinions on whether, as the frequency of training increases, they observe increased involvement of employees in shaping a culture of health and safety at work. In addition, question number one also showed a very high correlation value with question number five, which was 0.997. Question number 5 concerned whether, in the opinion of respondents, the choice of the method of conducting training in the field of occupational health and safety affects the level of understanding of the subject matter. Taking into account both values of the above-mentioned correlations, it can be concluded that not only the frequency of training, but also the selection of methodology for the training undertaken has a significant impact on the understanding of the information and health and safety at work in steel plants.

A very high correlation was also shown by question number 3 and question number 10, where the correlation value was 0.979. Question number 3 is to conduct trainings using didactic materials in the form of scripts or multimedia presentations. On the other hand, question number 10 concerned the respondents' opinions on whether, in their opinion, the involvement of the trainer in the training affects work safety throughout the company. From such a high correlation value, it can be concluded that the activation of training participants lies with the trainer and depends on his involvement in the training course. This is also confirmed by the correlation between question number 4 and question number 10, where question number 4 concerned the use of activating elements by the trainers. The correlation value in this case was 0.975. This is a very high correlation coefficient indicating a high relationship between the examined questions. In addition, a high correlation coefficient can also be observed between question number 9 and 10, whose correlation coefficient was 0.974. And question number 9 concerned whether, in the opinion of respondents, the presentation in a visual form increases the effectiveness of the training. Presentation in a visual form can also be a method of activating training participants because, depending on the content of the presentation, it may contain various means of communication (film, instructions, open question, problem to solve together, tasks for the group). Therefore, it can be concluded that the activation of training participants has a positive effect on occupational health and safety in the case of steel plants.

The darkest negative correlation is between question 2 and question 7, which is -0.367. Question number 2 concerned the variability of the methodology of conducting training depending on the subject. Question number 7 concerned the opinion whether, along with the increase in the frequency of training, you observe an increased involvement of employees, shaping the safety culture of your company. Therefore, it can be concluded that the variability of the training methodology depending on the subject matter is not correlated with the involvement of employees in shaping the culture of occupational health and safety. Taking into account the previous correlation results, it can be observed that the variability of the methodology of conducting training, in the opinion of respondents, does not affect the formation of occupational health and safety culture, but the activation of training participants. It can therefore be concluded that as the involvement of employees increases, the training is greater, their involvement in shaping the culture of occupational health and safety at the steel plant. This may result from the practical dimension of the training, where the employee, remaining in constant interaction with the trainer, remembers much more (Chatigny, 2022). Consolidation of information on occupational health and safety, in turn, determines the employee's tendency to behave more safely in his workplace (Niciejewska, Idzikowski, Lestyánszka-Škurková, 2021). A very important role in shaping these behaviors is played by all employees employed in the company (Duan, Zhu, K., Wang, Zhou, M., 2023). Thus, the promotion of socially responsible behaviour in the metallurgical sector is a very important safety factor Elles, R., Villabona, N., & Martelo, R. (2018). The greatest influence in shaping culture is the management and the occupational health and safety unit (Furman, 2023). Employee behavior can also be shaped using signs at workplaces to improve safety (Gunbeyaz, Kurt, Baumler, 2019).

3. Summary

Conducting training in plants with an increased risk of an accident at work or a potential accident situation is a very important aspect because it directly affects the level of safety at the steelworks. As research has shown, using a spreadsheet and correlation function, there is a very strong relationship between the activation of training participants and increasing the level of occupational health and safety in steel plants. Regarding occupational health and safety, this is a very important aspect of any training. The role of their ideas and knowledge can significantly contribute to reducing accidents. Therefore, the OHS service should use this form of training as often as possible to eliminate individual threats in the work environment. The second important aspect is the frequency of training, which, as respondents declare, is strongly correlated with increasing employee involvement and shaping a culture of occupational health and safety at steel plants (Claxton, Hosie, Sharma, 2022).

References

1. Barnová, S., Krásna, S., Gabrhelová, G. (2019). E-mentoring, e-tutoring, and e-coaching in learning organizations. *Edulearn, 19. Proceedings*, 6488-6493.
2. Brown, K.A., Willis, P.G., Prussia, G.E. (2000). Predicting safe employee behavior in the steel industry: Development and test of a sociotechnical model. *Journal of Operations management, 18(4),* 445-465.
3. Chaib, R., Taleb, M., Benidir, M., Verzea, I. (2014). Promoting in companies a successful culture of health and safety. *International Journal Of Safety And Security Engineering, 4(1),* 64-76.
4. Chatigny, C. (2022). Occupational health and safety in initial vocational training: Reflection on the issues of prescription and integration in teaching and learning activities. *Safety Science, 147.*
5. Claxton, G., Hosie, P., Sharma, P. (2022). Toward an effective occupational health and safety culture: A multiple stakeholder perspective. *Journal Of Safety Research.*
6. Duan, X., Zhu, K., Wang, X., Zhou, M. (2023). Reform of the Training Program of Intelligent Manufacturing Engineering of Universities in the Steel Industry. *Sustainability, 15(5),* 3952.
7. Einarsdóttir, M., Snorradóttir, Á. (2020). OHS education and safety training of teenage workers in Iceland. *American Journal of Industrial Medicine*. *63*(2), 188-198.
8. Elles, R., Villabona, N., Martelo, R. (2018). Occupational Health and Safety Management in Companies in the Metalworking Sector. *Contemporary Engineering Sciences, XI, 39,* 1901-1909.
9. Furman, J. (2023). Training within industry (TWI-JS) program as a tool to improve work safety in the steel industry in Poland. *Metalurgija, 62(3-4),* 477-479.
10. Furman, J., Małysa, T. (2023). The role of visual management in the organization of safe work in production companies. *Production Engineering Archives, 29(2),* 195-200. https://doi.org/10.30657/pea.2023.29.23.
11. Gajdzik, B. (2008). The new culture of the safety of work in the steelworks plant. *Journal of Engineer*.
12. Gembalska-Kwiecień, A. (2018). Advancement of tools supporting improvement of work safety in selected industrial company. *Management Systems in Production Engineering, 26(1),* 31-34.
13. Gunbeyaz, S.A., Kurt, R.E., Baumler, R. (2019). A study on evaluating the status of current occupational training in the ship recycling industry in Bangladesh. *WMU Journal of Maritime Affairs, 18,* 41-59.
14. Jebb, A.T., Ng, V., Tay, L. (2021). A review of key Likert scale development advances: 1995-2019. *Frontiers In Psychology, 12*.

15. Lakra, N.R. (2016). Assessment of employee training: the case of steel industry in India. *IUP Journal of management Research, 15(4),* 59.
16. Lee, F.H., Lee, T.Z., Wu, W.Y. (2010). The relationship between human resource management practices, business strategy and firm performance: evidence from steel industry in Taiwan. *The International Journal Of Human Resource Management, 21(9),* 1351-1372.
17. Mollo, L.G., Emuze, F., Smallwood, J. (2019). Improving occupational health and safety (OHS) in construction using Training-Within-Industry method. *Journal of Financial Management of Property and Construction*.
18. Moose, E., Reszka, A. (2010). Teaching methods used in the formation of key competences. Foreign languages, operational methodology manual. Lublin: Wydawnictwo Naukowe Wyższa Szkoła Ekonomii i Innowacji (University of Economics and Innovation).
19. Niciejewska, M., Idzikowski, A., Lestyánszka-Škurková, K. (2021). Impact of Technical, Organizational and Human Factors on Accident Rate of Small-Sized Enterprises. *Management System in Production Engineering, 2(29).* 139-144. DOI: 10.2478/mspe-2021-0018.
20. Panfil, R.J. (2013). Pragmatics of contemporary teaching-learning methods. *Educational Forum, Vol. 25, No. 2(49),* pp. 89-101. University of Lower Silesia.
21. Paulus, P.B., Kenworthy, J.B. (2019). Effective brainstorming. *The Oxford handbook of group creativity and innovation*, 287-386.
22. Regulation of the Council of Ministers of 2 September 1997 on occupational health and safety services. Dz.U. 1997, No. 109, item 704 (announced text).
23. Rybina, G.V., Fontalina, E.S. (2020). *Some Aspects of Individual Approach to Learning Based on Tutoring Integrated Expert Systems*. V International Conference on Information Technologies in Engineering Education (Inforino), 1-4.
24. Saunders, R., Cardoso, S., Le Pouésard, M., Breslin, C., Myers, K., Swift, M., Collins, T. (2020). Addressing essential skills gaps among participants in an OHS training program: a pilot study. *Policy and Practice in Health and Safety*, *18*(2), 169-185.
25. Srihandayani, T., Marlina, L. (2019). Using brainstorming technique in speaking activity for senior high school students. *Journal of English Language Teaching*. *8*(1), 22-32.
26. Suasapha A.H. (2020). Skala Likert Untuk Penekitian Pariwisata. *Beberapa Catatan Untuk Menyusunnya Dengan Baik, Vol. 19, No. 1,* pp. 26-36.
27. Tracz, M., Rachwał (2008). Teaching methods and didactic means used by teachers of the basics of entrepreneurship, research results. *Entrepreneurship-Education, 4*, 335-340.
28. Vranješ, B., Todić, M. (2019). A model of analysis of the occupational safety and health system in the production system. *Journal of Applied Engineering Science, 17(3),* 264-272.
29. Wolniak, R. (2013). The assessment of significance of benefits gained from the improvement of quality management systems in Polish organizations. *Quality & Quantity, 47,* 515-528.