

Chapter 37

Andragogy and Active Methodologies in Regulatory Standards Training of High-Performance Activities: An Experience in a Pharmaceutical Laboratory



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Abstract Objective: The present research aims to raise a discussion about the use of pedagogical practices in workplace safety training, aiming to identify failures of the Regulatory Standards (RS) regarding the training requirements such as periodicity and level of instruction or training of instructors. Therefore, the general objective aims to present the active methodologies applicable to training in RS, through the use of andragogy. **Method:** A bibliographic and field research was conducted through the application of a questionnaire to a small exploratory convenience sample to verify the main complaints or doubts of the collaborators regarding the training, namely the workload, teaching practices and also seeking to identify their opinion regarding the importance of the presence of teachers to provide training. **Results:** The analysis of the results allowed to identify some critical points in the RS, which fit pertinent changes, as well as to identify how important the application of pedagogical practices and strategies can be, such as andragogy guiding instructors regarding the treatment of adults in the learning process. **Conclusion:** Problem-Based Learning (PBL) emerges as the most attractive pedagogical practice to deal with training, transforming technically technicist teaching into a more efficient and attractive teaching-learning process for employees, mainly since the vast majority of training participants have not been in school environments for some time.

Keywords Training · Regulatory standards (RS) · Andragogy · Problem-based learning (PBL)

37.1 Introduction

Regulatory standards (RS) training are legal requirements, becoming essential for the development of a safe operating procedure, and sometimes neglected by employers and employees, especially concerning the content demands taught. A thorough analysis of the RS ends up generating doubts as to the competent professional who provide the various training, becoming a discussion that is always present in the Specialized Services in Health and Occupational Medicine (SSHOM) of companies and consultancies, and often causes refuse training or training certificates.

The lack of clarity on the part of the conductors of RS training regarding the qualification of these professionals to give the training, coupled with a technicist content, comes up against the level of education of the employees who will undergo the training, and they often find themselves out of a classroom for years, failing to skilfully absorb the information entered, which is sometimes exposed by professionals who do not have a pedagogical vision.

Therefore, the question is: how Andragogy and which methodologies would be applicable in RS training to obtain attention and training efficiently? The problem of this study was defined as a general objective: to present the active methodologies applicable to training in RS, in the use of andragogy. From the general objective, the following specific objectives were defined: to discuss Work Safety Engineering and RS; conceptualize Andragogy and the active methodologies and their application in

the training of RS; present the results of the research carried out with employees who undergo the training of a large pharmaceutical laboratory.

This study is of utmost importance since it seeks a way for Andragogy to establish an adaptation to the standards and to the satisfactory attendance of syllabus contents combined with training with innovative and creative classes, leaving aside the technical aspect. This work was based on seeking alternatives that corroborate the theme, to demonstrate the importance of andragogy in learning activities regardless of the educational or technical focus.

37.1.1 Workplace Safety Engineering and Regulatory Standards Training

To achieve satisfactory results, it is necessary to create a parallel between already existing theoretical bases and the research theme. Health and safety are essential to have a healthy and productive environment and that the awareness and training of employees becomes a key point to avoid accidents at work [5, 17, 18]. The author also reports that subtracting the efforts of the workers as much as possible was the best way to achieve the results, reverted to profit, but that currently there are ethical standards that influence the final results.

The legal requirement for training in occupational safety can be found through Regulatory Standard 01 (RS01): General Provisions and Occupational Risk Management, more specifically in its item 1.7 Training and training in Safety and Health at Work. Such item of the referred standard disposes of the mandatory training, the acceptable ways of giving face-to-face and distance or semi-presence training, as well as allowing each regulatory standard to have the autonomy to define the workload and program content, among other legal requirements pertinent training of workers.

Cultural issues can, many times, become significant obstacles to the changes required when implementing the Occupational Safety Management System (OSMS). Therefore, knowing the maturity of the existing culture in a company is essential for the formulation of change plans, when necessary [7]. The culture change of organizations always appears in the discussions regarding safety and environmental management, as being a great obstacle, since many managers face the requirements imposed by RS as expenses. Perhaps the culture change, combined with a new approach, would show that the investment now becomes a return in the medium and long term.

Seewald [16] sought to propose a new training program for construction workers, such proposal consisted of carrying out a systemic approach in six parts, namely: defining the profile of the employee; define the objectives of each training; diagnose management needs; planning; application and execution and, finally, feedback assessment. Trainings in RS have become technicians, consequently dull and not very productive, as frequently questioned by training participants who constantly

complain about the workloads or approach taken, as well as methodologies such as andragogy, which focuses on adult education and methodologies active, which place the student as an agent responsible for their learning, appear as interesting alternatives to be addressed and applied to training.

37.1.2 Andragogy and Active Methodologies Applied to Regulatory Standards Training

A new approach to be applied in safety training is the main objective of this study, seeking to find information and data that corroborate the importance of such training combined with active methodologies, especially for adults. Most training is aimed at updating and improving the technical skills of employees and is increasingly important for two reasons: assimilation of new technologies and new models of organizational structures [14].

When looking for a pedagogical approach to be inserted in the context of this study, the need to search for knowledge and information about andragogy is implicit, since the professionals involved in safety training are all adults, and in many cases have been for years outside the school environment. Therefore, Paulo Freire's teachings are essential. "To be valid, every education, every educational action must necessarily be preceded by a reflection on man and an analysis of the concrete way of life of the concrete man to whom we want to educate (or better said: to whom we want to help to educate ourselves)" [9, pp. 33–34]. In this way, combining the concepts of Andragogy, defined by Malcolm Knowles [10] as: "the art of orienting adults to learn", teaching practices based on the student's experiences, as Paulo Freire proposed, can effectively collaborate for the proposition of a pedagogical approach focused on training. It presupposes the definitive assumption, by the trainer and the trainee, of an attitude of recognition that the adult, the subject of his self-development, must face learning of participation, problem-solving and answers to his real needs [6]. The concept of Andragogy reflects the view that instructors should act as facilitators, prioritizing the teaching-learning process and not the content to be taught, making it clear that the content must be fulfilled, but it cannot be the focus. Therefore, andragogy leads us to believe that instructors must behave, nothing more than as legitimate teachers. Franco et al. [8] carried out a case study in a metallurgy company, which in 2010 hired a consultancy company to implement and conduct a training course for internal instructors, with an emphasis on andragogy, and found favourable results to this application, among them the contribution of the trainees in the teaching/learning process, based on their experiences and previous knowledge of the subjects covered in the instructional events, as Paulo Freire has always made clear in his studies.

The General Manager reinforces that, with the reduction of authoritarianism, there are more constructive discussions at all levels of the company. He highlights the improvement in the absorption of training content, as he believes that the use of

andragogy facilitates the level of understanding of all adults. To support this belief, the manager presented a learning absorption scheme, proposed by Bellan [4], who considers that a person absorbs: 10% of what he reads; 20% of what you hear; 30% of what you see; 50% of what you hear and see; 70% of what you argue with others; and 90% of what he/she says, as he/she does it [8].

Pavan [13] concluded that, for university professors, it is essential to have a holistic view of the ways to approach the curricular content and sensitivity to their students' ways of learning. This finding by Pavan corroborates the problem raised in this work, contributing to the discussion, stating that active methodologies contribute to higher education, and it is also possible to apply to safety training, transforming them into a teaching-learning process.

Teachers look for alternatives to deliver the content in a way that reaches their teaching to a larger number of learners. However, for some disciplines and courses, whether very practical or interdisciplinary, it is common to encounter difficulties in explaining the teacher. Thus, some teachers seek alternative ways to teach their subjects, to improve the didactics of their teaching art in the classroom, with the emergence of active methodologies [15].

The learning methodologies consist of systematic processes to characterize the way to carry out the insertion of the student with the process of assimilation of content (learn) among the various methodologies. The active methodologies stand out for this study. The active methodologies in a way go against the traditional learning methodology, which places the student as a passive agent within the process; therefore, the active methodologies, as the name says, insert the student as an active character, playing an important role in their learning process. Among the main active methodologies, we can highlight project-based methodology, problem-based, and mental maps [11].

37.2 Material and Methods

This work is based on bibliographic and field research, which served as a basis for the application of the questionnaires and consequently for the analysis of results and proposition of changes. In this way, the line of research focused on four specific parts: the legal requirement for safety training and fundamentals of andragogy and active methodologies. The research was developed by applying a varied methodology, consisting of a "quali-quantitative" approach to data collection, bibliographic review to theoretically corroborate the problem raised, and applied nature, since one of the objectives is to contribute with artifices that make training in RS less technical.

The "quali-quantitative" survey consisted of research of studies on the topic, as well as information collection in several companies from various economic sectors, but who suffer from the requirement of training their employees, requesting feedback on past training, opinions and suggestions so that the theme can improve and become more productive. The quantitative data was collected through a checklist applied in the form of a "reaction assessment" after the participants finish any

training of RS, which can be training with different workloads and also different RS. The checklist presented the information and later that data was analysed.

Training materials from research and downloads via the internet were also analysed so that information can be collected that the materials are repeated and do not have an approach or pedagogical criteria.

For the bibliographic review, studies and technical literature were considered, using material written by Paulo Freire in the 1980s and other analyses and articles on the subject in the last 20 years, focused on andragogy, based preferably on the author Paulo Freire and teaching method adult learning through discussions about the reality and life experiences of the student, in this specific case, of the training participants. Such a bibliographic review will contribute to the construction of the theoretical foundation and the basis for proposing improvements regarding the theme since this study, after analysing the results.

The application, driven by the theme and interest in proposing changes in the structures and ways of approaching training courses in RS, seeks solutions that can cause significant changes in the way that RS, nowadays governed by the Special Labour Secretariat, which are already undergoing revisions and recycling. Such application envisages creating a proposal for alteration regarding RS training, directed with the aid of bibliographic review.

For the development of this work, the active methodology Problem-Based Learning (PBL) [19], or teaching based on problems, which addresses the process of teaching-learning through case studies, or as the name suggests, addressing the problems of the student's experience and succinctly the role-play, was considered and analysed.

37.3 Results and Discussion

37.3.1 The Opinion of Workers Regarding Workloads and Content Taught in Regulatory Standards Training

The research carried out had the application of a questionnaire in the training class on RS 20 in fuels and flammables, of advanced level I, with a workload of 20 hours, in a large pharmaceutical laboratory, which for contractual reasons, allowed that such questionnaire was applied as long as it kept the confidentiality of the employees, of the company and that the employees were given the option of replying. Thus, the group consisted of 22 professionals (since the work was developed in a specific pharmaceutical laboratory, the number of participants is considered satisfactory), distributed in 2 forklift operators, 6 boiler operators and 14 electricians. It is worth mentioning that a previous visit to the training was carried out to identify the particularities. The results of the questions that would allow numerical measurement are described in Table 37.1.

Table 37.1 Questionnaire assessment

<i>Student</i>	<i>1. Number of trainings</i>	<i>2. Assessment of past trainings</i>	<i>4. No. of teacher instructors</i>	<i>5. Would you consider training given by a teacher to be important?</i>	<i>10. How would you rate pedagogical training?</i>	<i>11. Did you know that personalized training is a form of pedagogical approach?</i>	<i>13. Note from this training</i>
<i>1</i>	8	7	0	Yes	8	Yes	8
<i>2</i>	3	8	3	Yes	8	Yes	7
<i>3</i>	6	8	9	Yes	8	Yes	9
<i>4</i>	75	8	0	Yes	9	Yes	7
<i>5</i>	30	8	7	Yes	10	Yes	10
<i>6</i>	8	7	5	Yes	8	No	10
<i>7</i>	5	9	Inconclusive	Yes	10	Yes	10
<i>8</i>	Inconclusive	Inconclusive	Inconclusive	Yes	9	Yes	9
<i>9</i>	5	5	8	Yes	10	No	10
<i>10</i>	4	8	1	Yes	10	Yes	10
<i>11</i>	8	Inconclusive	Inconclusive	Yes	Inconclusive	Inconclusive	10
<i>12</i>	22	9	0	Yes	10	Yes	10
<i>13</i>	50	8	Inconclusive	Yes	10	Yes	10
<i>14</i>	15	8	Inconclusive	Yes	6	Yes	8
<i>15</i>	Inconclusive	8	8	Yes	Inconclusive	Yes	8
<i>Total</i>	239		41				
<i>Average</i>	18.38	7.76	4.1		8.92		9.06

Source: Research applied to employees of a pharmaceutical industry located in Anápolis-GO, Brazil, in January 2020

Figure 37.1 presents the opinion of the training participants regarding the importance of a pedagogical approach and it would be considered important to receive training given by professionals with experience as teachers. Before they received the questionnaire, they were instructed on how to write down the answers, and for those who claimed doubts, an explanation of what would be the pedagogical approach was given.

According to Fig. 37.1, the participants who presented a conclusive answer claimed to consider important the presence of a professional with experience in learning, and the vast majority understood that personalized training is one of the forms of the pedagogical approach.

In contrast, Fig. 37.2 shows the relationship between the number of trainings versus the number of teachers who gave them. In concrete numbers, the discrepancy is visible, considering that in a contingent of 22 participants, 15 were willing to complete the questionnaire, and together they totalled 239 trainings received, being only 41 teachers, taking into account that some collaborators may have participated in training together previously. This factor was not considered, since there was no access to the entire training history of these professionals.

Therefore, if you create a parameter to guide the results obtained in the questionnaire, you can raise the hypothesis that training focused on occupational safety would present differentials once taught by professionals with experience in pedagogical practices.

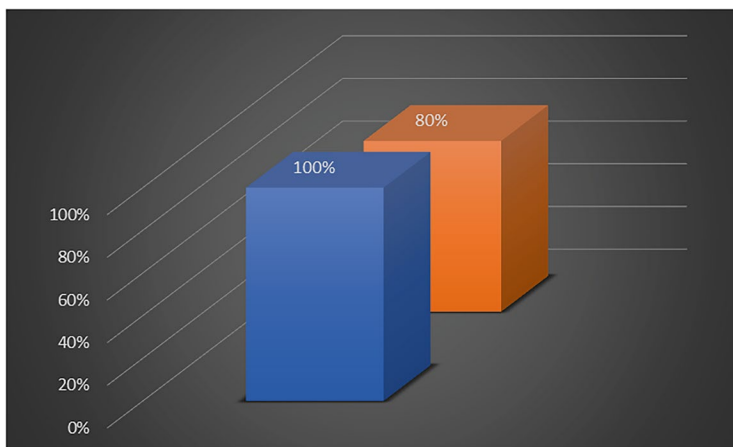


Fig. 37.1 Participants' opinion on the importance of a pedagogical approach. In blue, the percentage of participants that consider a training given by a teacher to be important; In orange, the percentage of participants who know that personalized training is a form of the pedagogical approach

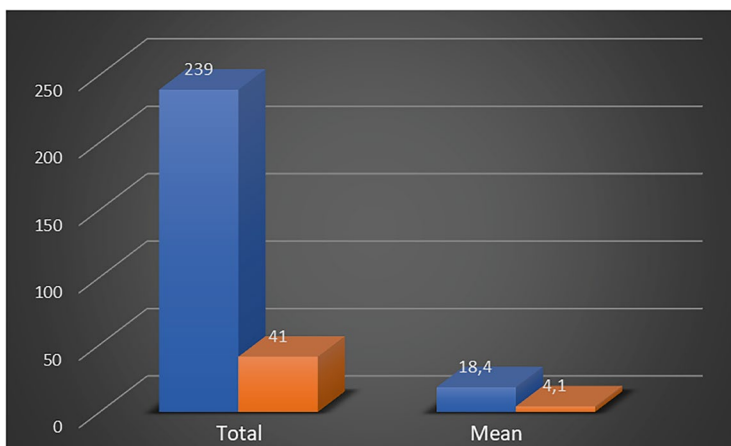


Fig. 37.2 Total $\times$ Mean – No. of Trainings $\times$ No. of Teachers. In blue the trainings; In orange the instructors/teachers

37.3.2 Standards Analysis

In this item, information on the main standards that require training is assessed. These provide, as a basis for the preparation of the training, the following information to be analysed: workload; programmatic content (if specific); level of instruction or instructor and frequency. As for the standards that had such information raised, they were: RS05—Training for members of the Internal Commission for Accident Prevention—CIPA; RS06—Training on guarding and conservation of collective protective equipment; RS07—First aid training; RS10—Safety training for electrical services; RS11—Cargo and material handling training; RS12—Safety training on machines and equipment. RS12—Safety training in machines and equipment, has a series of sub-training, which are: RS13—Safety training in boilers, pressure vessels and industrial pipes; RS18—Admission and periodic training in civil construction; RS20—Fuel and flammable safety training; RS23—Firefighting training; RS33—Safety training in confined space services and RS35—Safety training at work at height.

Table 37.2 presents the results in which some items are referenced with captions, as explained below. Therefore, (*) the item listed below predisposes who will be considered an authorized and trained worker, not making it clear what the instructors' level of instruction is, setting a precedent to be performed by the legally qualified professional—Electrical Engineer—or by an authorized professional to whom does not refer to attributions, therefore, the information was classified as (N) No. RS 10 states that skilled workers are those who meet the following conditions simultaneously: receive training under the guidance and responsibility of a qualified and authorized professional, and work under the responsibility of a qualified and authorized professional.

Table 37.2 Result of the standards review

Training	Workload	Specific content	Instructor's level of instruction	Periodicity	Observations
RS05	Y	Y	N	Y	–
RS06—IEP	N	Y	N	N	Equipment varies according to the company's activity
RS07—First Aid	N	N	N	N	–
RS10—Basic electrical services	Y	Y	N*	Y	Cites the only workload for initial training, not for recycling
RS10—Electric Power System	Y	Y	N*	Y	Cites the only workload for initial training, not for recycling
RS11—Handling of plates and ornamental rocks	Y	Y	N	Y	It has annexe I contemplating the modules for training
RS11—Handling and storage of materials and loads	N	N	N	N	–
RS12—Machinery and equipment	N	N	N**	N	Defines workload only for training in injection moulding machines
RS13—Boilers	Y	Y	Y***	N	–
RS13—Pressure vessels	Y	Y	Y***	N	–
RS17—General ergonomics	N	N	N	N	–
RS17—Ergonomics telemarketing and checkout	Y	Y	N	N	–
RS20—Initiation	Y	Y	N	Y	Requires instructor proficiency
RS20—Basic	Y	Y	N	Y	Requires instructor proficiency
RS20—Intermediate	Y	Y	N	Y	Requires instructor proficiency
RS20—Advanced I	Y	Y	N	Y	Requires instructor proficiency
RS20—Advanced II	Y	Y	N	Y	Requires instructor proficiency
RS20—Specific	N	N	N	N	Requires instructor proficiency

Table 37.2 (continued)

Training	Workload	Specific content	Instructor's level of instruction	Periodicity	Observations
RS23—Fire fighting	N	N	N	N	—
RS33—Confined Space—Authorized and watchman	Y	Y****	N	Y	It requires the proficiency of the instructor, specifies even hours of recycling
RS33—Confined Space—Supervisor	Y	Y****	N	Y	It requires the proficiency of the instructor, specifies even hours of recycling
RS35—Work at height	Y	Y****	N	Y	Requires instructor proficiency

Y yes, N No

Source: Research applied to employees of a pharmaceutical industry located in Anápolis-GO, Brazil, in January 2020

Regarding the No (N**) in the table, it was due to the interpretation of the item that does not specify which level of instruction of the instructor, making it clear only when citing the legally qualified professional who in this case is the Mechanical Engineer, thus RS12 states that: “12.16.1 The operation, maintenance, inspection and other interventions in machinery and equipment must be carried out by qualified or qualified or trained workers, and authorized for this purpose”.

Concerning the symbol (***), it mentions that the supervision of the training must be carried out by a legally qualified professional—Mechanical Engineer according to the Federal Council of Engineering and Agronomy, which according to RS13 reveals that safety training in boiler operation must mandatorily: be technically supervised by a qualified professional; be taught by professionals trained for this purpose. Thus, it is not clear what level of instruction the instructor should have, since only training supervision is clearly defined, so the assessment was that No (N) there is clear information in the standard. ****When stating that the instructor needs to be proficient, the standard sets an open precedent for anyone to be an instructor, so the assessment was of No—N.

Table 37.2 shows how the standards are unclear as to the level of education of professionals able to provide safety training for RS, once 23 training sessions have been screened, and only 3 are clear about the professional who should provide such training. It thus raises discussions about this issue, which can promote doubts about interpretations both by professionals who offer these types of services and by customers when defining which offer fits their needs, so that there are no complications when assembling the document portfolio required by labour inspection agencies, such as the Special Labour Secretariat, currently linked to the Brazilian Ministry of Economy.

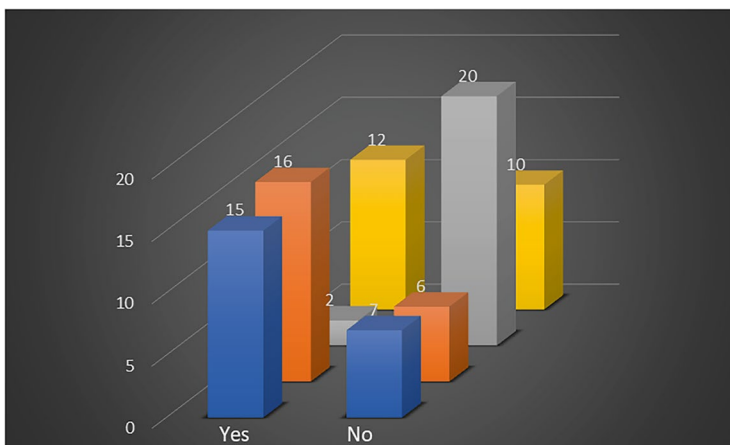


Fig. 37.3 Quantitative of the level of education of professionals able to provide training. In blue the workload; In orange the content; In grey the level of education; In yellow the periodicity

Figure 37.3 represents the percentage of answers yes or no, for the assessed items: periodicity, level of education, content and workload. Where it can be observed that the item that presents more critical levels but still below the level of instruction, is the item periodicity, presenting almost half of the standards that do not specify what the training periodicity should be. Thus, another possible doubt is raised in the teams that coordinate the security management of the companies and perhaps the labour tax auditors who are in charge of inspecting these companies and the relevant labour documentation.

When the analysis goes to the syllabus, although they are present in more than 70%, they are described generically, without explaining the methodology to be used, leaving this definition to the instructor, who often, due to the absence of specificity regarding their level of education, they may not have experience with learning methodologies.

37.3.3 Adequacy of Content and Technical Specifications Regarding Regulatory Standards Training and their Possible Variants

As analysed in the previous items, some points of the standards leave work safety professionals a little adrift, with no clarity of what choices to make when hiring or offering training services, since all the work safety documentation as well as the others labour obligations are audited and must comply with a series of protocols and requirements to avoid embargoes, interdictions and even assessments. Therefore, an adaptation of the standards regarding the items that presented critical indices of doubt and even a lack of clarity will become appropriate measures to be taken. All

of this can be combined with the fact that the current federal government since its inauguration, has been carrying out a series of updates to the RS, a fact that would corroborate for this update regarding training, whether updating each item individually or creating a new regulatory standard, which would be specific for training.

This specific standard would deal with each training individually, clarifying all ambiguities and doubts that are present, highlighting the instructors' level of instruction, syllabus and periodicity, in addition to citing and exemplifying pedagogical approaches.

37.3.4 Active Methodologies Applicable to Regulatory Standards

Among the existing active methodologies, the PBL [19] variant, presents itself as promising, providing an amplitude to the specific approach for each participant's need, and the instructor can "create" a training X for a dairy and a Y for a pharmaceutical laboratory, for example. This learning emerged in the 1960s, in Canada, where it was initially applied in medical schools. Currently, it has been used in the areas of administration, architecture, computer science, social science, economics, engineering and mathematics [1]. PBL seeks to transform a problem as a basis for learning motivation, emphasizing the construction of knowledge in a collaborative environment. The idea is not to always have the problem solved at the end but to emphasize the process followed by the group in the search for a solution. Barbosa and Moura [2], concluded that PBL presents a lower risk compared to Project-Based Learning, another variant of active methodologies since the themes chosen to address the problems are the responsibility of the teacher, thus minimal control of the content to be taught.

Another learning methodology that can collaborate with the application and differentiated training, role-plays which is an interactive teaching strategy where during the learning process the participants will assume roles making their participation active and even playful [12]. The role-play aims to:

- Knowledge: the cognitive area that involves the student's mental and intellectual aspect, his ability to think, reflect, analyse, compare, criticize, justify, argue, interfere with conclusions;
- Affective-emotional: development of the affective-emotional area, which denotes opening space for aspects such as attention, respect, cooperation to be expressed and worked on;
- Development of the area of human and professional skills: learn to express yourself with ease in interactivity relationships;
- Development of attitudes and values: it means taking responsibility for your learning process.

This teaching strategy is similar to the active methodology PBL as it addresses games, dynamics and playful interactivity to address the topic to be taught, and the application of the role-playing strategy combined with PBL can be of great value, integrating case studies, recurring problems in the participant's reality (PBL strategies) to the role-play dynamics [3].

37.4 Conclusions

This study aimed to analyse and discuss how the RS approach training courses on occupational safety, elucidating issues that leave doubts amid work safety, both from professionals qualified in work safety or from managers in a general way, and find a way to apply pedagogical practices in an extremely technical environment such as engineering.

A questionnaire was applied to employees of the pharmaceutical industry who received training in RS20—Combustible and flammable, to identify their opinion regarding the importance of pedagogical approaches in training, realizing that employees receive countless training throughout their careers and they are often unaware of what a pedagogical approach would be, being able to notice how important the presence of professionals with experience in teaching-learning to teach the training was important. It became clear after assessing the questionnaire that a pedagogical practice can positively influence the acceptance of employees when receiving training.

The review of the RS presented considerably critical levels in two aspects. The level of education of the professionals responsible for providing the training, with a negative index close to 80% of the standards that are unclear as to the training or minimum level of education that the professional involved in providing the training must have, leaving a doubt both in terms of professionals who want to offer such specialized training services as well as managers who need to control and hire training for their team. And the other important aspect concerns the periodicity of conducting the training or their recycling, with indexes between 50% and 60% of the standards not directly and objectively mentioning the periodicity of the training in work safety, leaving another doubt hovering on professionals involved with such issues.

Finally, a bibliographic review was carried out to identify which pedagogical methodologies would best suit the practice of training, thus finding in andragogy, a pedagogical practice aimed at adult education, an approach that can contribute to direct instructors in the way to proceed in their training, as they often meet adults and young adults who have not been in a school environment for years. Allied to this, it was possible to verify the active methodologies, such as the best practice options and pedagogical approaches to transform training into a teaching-learning process. The active methodology based on PBL remains as the main pedagogical approach to be applied in training, since they insert the participant as an active character in their learning process, addressing the main problems of their experience. It

was also considered as an efficient strategy allied to the PBL, the role-play that consists of carrying out dynamics, games and playful activities with the participants, when they take an active place in the process.

It is also suggested that RS undergo updates regarding training with an emphasis on aspects that are considered critical and/or the development and implementation of a new Regulatory Standard, exclusive, with all the applicable requirements to solve the doubts related to work safety training, which would be RS38, becoming an objective point of reference to clear up doubts and ambiguities regarding RS training. In future studies, an expert opinion on the metal should be considered and the approach applied in other activity sectors with larger samples.

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