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Andragogic Strategies to Implement the Culture of Safety in the Sewerage Construction Workers of the Metropolitan Public Company of Drinking Water and Sanitation of Ecuador

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Abstract

One of the serious problems that occur in any productive or operational system is the lack of culture of prevention and safety at work, resulting in occupational accidents that cause serious injuries or even death. This article presents the case of workers from the Drinking Water Company in the area of construction and maintenance of sewage networks. Its objective was to determine the need for training and the design of andragogic methods to strengthen the culture of prevention. This work is an exploratory type research, in which the inductive method of investigation was used. In order to know about occupational health and safety, and the use of safe work rules and procedures, a diagnosis was made, by means of various information gathering techniques, including job analysis. As a result, the establishment of the degree of knowledge and the shortcomings of training were obtained, allowing the production of appropriate themes with the use of andragogic training models which directly imply the establishment of a preventive culture.

Key Words: Andragogy, prevention, safety, workers.

Introduction

There are differences between pedagogy and andragogy as methods of teaching and justifying why andragogy is most suitable in teaching adults. Although pedagogy and andragogy has become popular both within and outside adult education circles (Haruna, 2015). About the andragogy there are many researches since Malcolm Knowles in 1973, is considered as the art and science of helping adults to learn, for which it is necessary to implement strategies that allow them to participate actively in their own learning. It should be noted that adults

deserve to know why they should learn something, because they are responsible for making decisions that affect their lives daily and even their peers. Therefore, they are willing to learn what is necessary to effectively face risk situations that their work imposes; focusing on their life by guiding their learning and responding better to internal motivators in relation to external motivators (London, 1973; Elias, 1979; Mckenzie, 1979; Hartree, 1984; Davenport and Davenport, 1985 and Haruna, 2015). The provision and availability of water is a

determining factor in the expansion of life, all living beings need water for their vital functions. Due to population growth, the service to be provided makes the entire network of potable water and sewerage distribution pipes subject to implementation and improvement processes, planned and controlled changes with preventive, corrective and emergent maintenance plans for distribution networks and household connections of drinking water, as well as the structural revision of networks and collectors, cleaning of road drains and sewer connections with repair or changes in networks that present damage to their structure, to improve and avoid possible floods, collapses and saturations of networks in times of heavy rains, in order to establish customer satisfaction. One of the keys and priority aspects in this sector is the safety of its workers. It is here where it has become clear that achieving good results in the absence of faults and accidents not only depends on the facilities and the processes themselves, but also depends on the way workers act. It is so important to have equipment and processes capable of correctly performing the required activities, as well as their own attitude, especially when the negative consequences of a failure or negligence often affect not only the person who performs them, but also their colleagues, users of their services and even people who have nothing to do with them. In the development of their professional activities the adult employee applies his own work methods developed with the passing of time by experience and custom for its better application. Such empirically applied methods present successful results without taking into account the risk to which the worker is exposing

himself, since he always develops his work in contact with mechanical tools, heavy machinery, inside confined spaces, open ditches, exposed to polluting fluids, being prone to commit errors in high-risk jobs that at certain moments can cost his life, thus increasing accident statistics. Attitudes of the adult worker when distrustful to follow the development of his tasks make the awareness of a safety culture more difficult. Within the course of the Northern Operations Unit personnel's work activities, a considerable number of accidents is not determined, but poor work practices are; which is why an approach and application of interactive andragiotic (Gitterman, 2004) training techniques to the adult worker is proposed, in order to make them acquire a culture of personal safety with multiplying effects on all workers. The aim of this work was to determine the need for training and the design of andragiotic methods to strengthen the culture of prevention in the sewerage construction workers of the metropolitan public company of drinking water and sanitation of Ecuador.

Materials and methods:

The research was developed in the North Sanitation Operations Unit (NSOU) which has 37 workers: 12 employees and 25 adult workers that constitute the universe of study. The classification by work group is indicated in Table 1, which carries out maintenance work on sewerage networks that leads to high-risk activities such as work in contact with mechanical tools, operation of machinery, work in confined spaces, slippage of ditches, etc.

Table 1: North Operations Unit's workers per activity

	Activity	Work
1	Mason	4
2	Driver	3
3	Driver - Eductor	3
4	Inspector	2
5	Digger machine	1
6	Peon	6
7	Siphon worker	6
	Total	25

The main element of study in the investigation is the worker who was identified in his daily tasks of sewer maintenance, using the individual personal files of each one. The inductive method, the analysis of positions and the risk factors that intervene in their

activity were applied by means of techniques such as: checklist, interviews and direct worker surveys to determine the relationship that lack of training has with the occurrence of accidents, taking into consideration the periodicity of the training sessions

that were applied to them. The surveys were elaborated with closed questions and determining variables from which results that identify the shortcomings that lead to suffering possible accidents to the worker who does not maintain a process of andragogic training derived. The hypothesis of the research, which in turn was its starting point, is that: the andragogic methods of training for the adult worker generate commitments in their activities, avoid accidents and improve

productivity. With the participation of direct and indirect variables, indicators and / or measures that are used in the development of this research, determining human talent that, with work methods applied, generates productivity and takes training as a fundamental part, which without an adequate approach the expected results would not be obtained. For the execution of this work the thread shown in Figure 1 was followed.

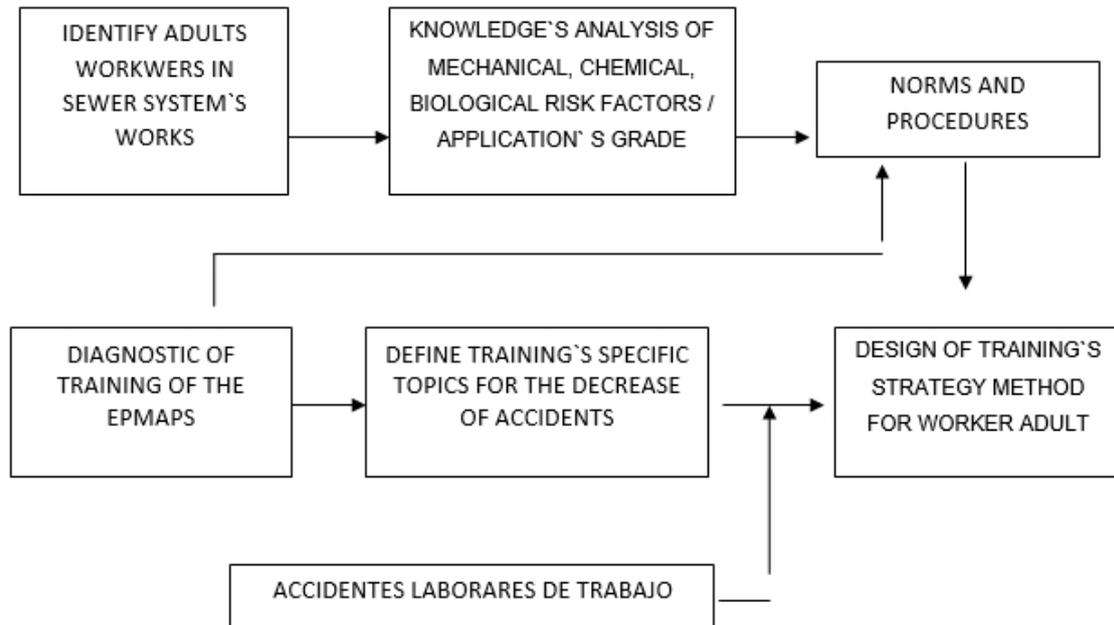


Figure 1: Thread conductor

Results and discussion:

In order to determine training strategies and methods on issues related to industrial safety and risk prevention of the adult worker who carries out construction and maintenance work in sewerage networks, an EPMAPS training diagnosis was made and its data are indicated in Table 2.

Table 2: Training per hours, period 2012-2013

	Managements	Training's
1	Administration and	9.150
2	Set	11.132
3	Commercial	14.770
4	Financial	5.212
5	General	6.346
6	Juridical	2.277
7	Operations	32.844
8	Planning	5.902
9	Talent	1.959
10	Technical infrastructure	11.813
	Total training hours	101.405

Once the areas were identified, the average age of the adult worker in the NSOU was determined, which is reflected in Table 3. The degree of acceptance that the adult worker must receive training with new andragogic strategies was considered as indicated in Table 4, to obtain beneficial results for himself, his family

environment and his productivity, considering the reduction of accidents, taking care of the physical integrity of the worker.

Table 3: Age workers average UONS.

	Activity	Age average
1	Mason	30.8
2	Driver	38.0
3	Driver - Eductor	47.3
4	Inspector	37.5
5	Digger machine	50.0
6	Peon	33.5
7	Siphon worker	37.8

Table 4: Acceptance new training methods

	Activity	Yes	No
1	Mason	75.0	25.0
2	Driver	100.0	0.0
3	Driver - Eductor	100.0	0.0
4	Inspector	100.0	0.0
5	Digger machine	100.0	0.0
6	Peon	100.0	0.0
7	Siphon worker	100.0	0.0

The environment where the adult worker performs daily tasks is highly complex, directly exposed to various risk factors, so that the risks by job position are identified and evaluated in routine and non-routine activities for each activity with accepted methods such as is the 3x3 matrix for assessment of occupational risks, determining the risk level and the convenience of implementing corrective measures taking into consideration the results presented by the risk matrix as important and moderate, so that in the working groups the following results are determined and the design of andragogic training strategies in subjects of greater influence and tendency to accidents is considered.

Table 5: Evaluation of job positions

Position	Risks	
Mason	Moderate risk, in exhibition to risk's factors:	
	Biological	Exhibition to virus, patasites and derived organic, exhibition to bacterias
	Ergonomic	Forced postures
	Mechanics	People's fall at the same level, blows/courts for objects tools, people's fall at different level, confined space.
Driver	Moderate risk, in exhibition to risk`s factors:	
	Physical	Extreme temperatures.
	Mechanics	Fall of objects for collapse or landslide.
	Sychosocial:	RoI`s Definition, autonomy.
Eductor`s operator	Moderate risk, in exhibition to risk`s factors:	
	Physical	Noise

Each worker in his daily activity needs a learning process so that his work is pleasant with favorable performance results to the company. The staff of the NSOU relates learning with knowledge in such a way that the decline in accidents in work days significantly decreases as indicated in Figure 2, which presents the accident rate between 2000-2009, which reflects that the worker has been acquiring safe work practices and learning new knowledge with the advance of the years.

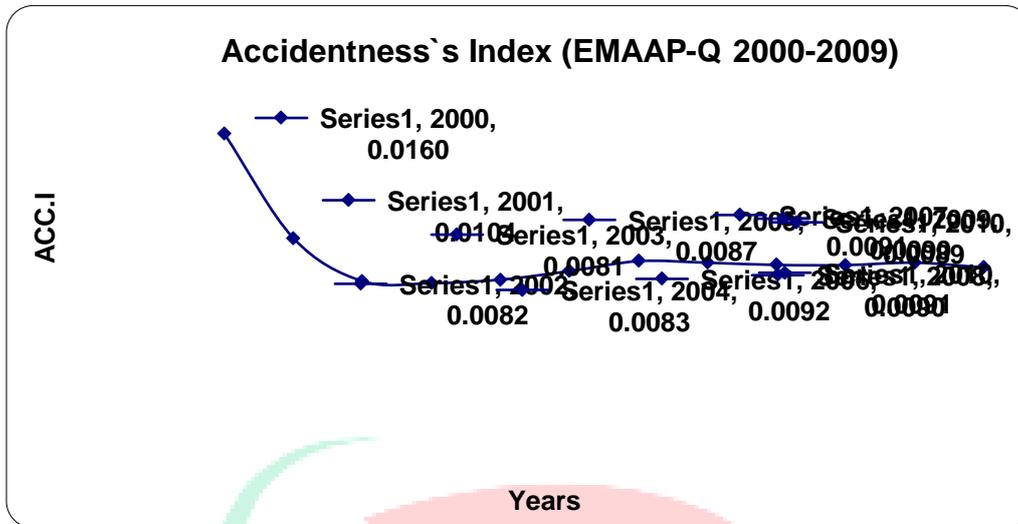


Figure 2: Accidentness's index

Current legislation measures safety management with reactive and proactive indices taking into account safety training, number of trained employees versus the number of employees scheduled, within the analysis it is determined that the resulting values of compliance are high, as observed in Table 6.

Table 6: Training in security

	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec
1	24	280	238	92	48	65	89	48	0	92	0	24
2	24	434	347	115	57	82	151	49	0	92	0	30
3	100.0	64.5	68.6	80.0	84.2	79.3	59.0	98.0	0	100.0	0	80.0

1. Employees's number training in the month.
2. Employees's total number programme in the month.
3. Security's training, ients %.

With the previous analyzes and the results obtained in the surveys applied to the staff about the acceptance of new andragogic training strategies, the application of a new method aimed at adult staff was proposed, with the following perspectives:

Characteristics of the model:

➤ The application of the andragogic training strategy is based directly on the human being learning skills disposed by nature, which are: the visual, to learn by observing; auditory, to learn by listening and the kinetics, to learn by doing. A training strategy is then developed and the subject to train is defined through illustrated presentations in this case videos about jobs assigned and performed by workers with life experiences told in adverse and real conditions,

- with immediate decision making to solve the problem.
- At the same time, interpretative readings and discussion panels about the work done and the conditions in which the work was developed are considered, brainstorming to improve the activity with the application of safety conditions improving the insecure acts applied in the work assigned.
- Real site work demonstration with conditions and situations that the worker develops daily.
- The process of assimilation of the information acquired by the worker according to the characteristics observed, taking into account the group of workers that learns in an analytical way, by logical and systematic steps; and the workers who learn in a global way, who concentrate and

learn when the information is provided in a total way without determining details and sometimes with a bit of humor propose fanciful solutions.

The evaluation is a process in which the Andragogic trainer and the trainee determine the degree of quality and quantity of knowledge acquired to achieve the objectives determined in the planning of the training. The evaluation focuses on the Andragogical trainee in the amount of knowledge comprehension and the approach he maintains for his social development and his work performance. For the andragogic evaluation a defined group relation is considered since it requires the self-evaluation of the participant, the co-evaluation of the group and that of the Andragogic trainer; considering itself in this way in bidirectional way with conditions of accepting or rejecting ideas of change and it takes great importance because it is a tool that strengthens dialogue and awareness in the trained subject, a simple and easy to understand format is defined. Kao (2017), evaluated the impact of in-service adult learners, self-directed learning and learning effectiveness on performance of project management competence, a case study of students with learning experience in project management courses and recommends that the self-directed learning of in-service adult learners with learning experience in project management courses should be assisted and their learning effectiveness promoted in order to enhance the performance of project management competence, encourage their sustainable development career and achieve project management goals. According with Deveci (2007), the educators should not assume that all their adult learners will be andragogic ally oriented. In organizing the educational settings and the materials, pedagogical factors need to be taken into consideration. It is also important to be aware of those who could be totally andragogical or pedagogical in a group. Only in this way can educators provide educationally appropriate opportunities for all individual learners, enabling them to reach more learners. Learners who are pedagogically oriented should be approached in pedagogical ways first. Then, step-by-step they could be helped to have and appreciate the andragogical experiences. Educators need to be informed about the concept of learning orientation. Educators who appreciate the importance of this concept and know how to use it would choose to find out the learning orientation of their learner from the very beginning. Educators should also learn their own orientation, which would allow them to make a comparison between their own and their learners' orientation, giving them the opportunity to build realistic expectations and arrange the learning

environment accordingly. The learning needs for adults that result from the constant increase in technology are rooted in the adult learning concepts of andragogy, self-directed learning, learning-how-to-learn, real-life learning, and learning strategies. Just as society is experiencing this eruption in dissemination of information through the Internet, adult education too is changing with the rapid expansion of research in the area of self-directed learning (Ghost, 2012). Is very important in the andragogy strategies the concept of self-efficacy. This concept is related to the belief that everyone has to evaluate their abilities to perform a given task successfully. This concept has a strong influence on the approach to the task, the persistence to accomplish the same, as well as the level of effort. There are several studies that show a correlation between the level of self-efficacy and academic results. In an online learning system that requires students' greater autonomy, as well as a higher level of persistence and effort in the learning tasks. To be aware and know the degree of self-efficacy of students seems particularly relevant (Goulão, 2014). Man is educable because he is endowed with abstract thinking, which enables him to use cognitive skills such as awareness of the self and the other, the concepts of space, time and the ability to change thought to execute more complex actions (Rivera, 1998). Also, he uses metacognitive skills such as informed decision-making, a fact that distances him from instinctive action. Thus, freeing himself from instinctive behaviors will allow him to educate himself by means of the apprehension of the stimuli of the environment and the enrichment of the experiences that will transform him as an individual being and as a member of a group. (Tarrío, s. f.) In this regard, Brant (2008: 22) refers: "Andragogy is responsible for education between and for adults", likewise, Marrero (2004) notes: "Andragogy is a discipline that studies the ways and procedures, techniques, situations, teaching-learning strategies in order to achieve significant learning by the adult participant. " Andragogy has been described as a science (Adam, 1970), a method (Lindeman, 1984), field of knowledge, discipline (Brandt, 1998), a theory (Knowles et al., 2001), and as an integral development process of the human being (Marrero, 2004). For Knowles et al., (2001), Andragogy offers the fundamental principles that allow the design and conduction of more efficient processes, in the sense that it refers to the characteristics of the learning situation, and therefore, is applicable to diverse contexts. On the other hand, Adam (1970) argues that it is an education that responds to the interests, needs and experiences lived by the student, that is,

an education of the human being in terms of its own rationality as such. Consequently, it is the adult who accepts, rejects or decides based on his/her own experience and interests the education to be received, along with the ups and downs involved in the changing and complex life of the human being. This author attributes to Andragogy the obligation to study the reality of the adult and determine the appropriate rules to direct his learning process. For Marrero (2004) Andragogy "is a human being's process of integral development, to access self-realization, self-transformation and the context in which the individual develops" (page 7). He further argues that Andragogy "seeks to mobilize and enhance knowledge, values, skills of solidarity and social commitment in each of us, and that the production of knowledge is creation, not repetition" (page 6). Andragogy is not limited to the acquisition of knowledge and improvement of skills and abilities, but consists of a process of integral development, where the individual grows as a person, professional, and a social entity that is part of a community in which he is able to function in the most appropriate possible way. From the bibliographic review it is considered that andragogy is the science of adult education that facilitates the knowledge and scientific treatment of his education. The adult can decide what to learn and why and be conscious of the terms of his own destiny. In the scenario of this research, Andragogy goes beyond the initial training for professional performance towards a permanent learning offer, addressed to workers who wish Andragogy helps them apply the culture of safety in their working environment. The andragogical strategy is based on a series of activities and tasks, with participation criteria and horizontality, to train the participants, according to their experiences in the handling of information through methods, techniques and procedures that allow them to effectively learn new knowledge in a self-directed way. In its methodology it is the way to plan, manage and direct the educational praxis of adults, emphasizing those aspects that in addition to supporting the orientation-learning process contribute to enrich the general or professional knowledge of the adult participant through self-learning. The safety culture is a term that encompasses the attitudes and values of people and the company in aspects related to safety, both in its way of understanding it and in its daily behavior. In many companies, activities that seek to reinforce the safety culture of its employees are carried out. In this way, people are educated and aware to achieve a better development of activities and a decrease in potential accidents and problems, both within the

workspace and in the services offered by the company. Among the advantages of having a strongly implemented safety culture is not only the reduction of accidents, but also an increase in the efficiency and competitiveness of the company: by getting employees to do their jobs correctly and eliminating the failures that could subsequently lead to non-quality costs (repairs caused by doing things wrong, complaints, loss of clients, etc.). Therefore, although initially we are talking about issues related to safety, in practice the benefits will also be noted in the reduction of errors in production and in an increase in the quality offered.

The aspects that determine the Culture of Safety are:

- ✓ Worker Awareness: Awareness is the main aspect. You must develop policies that encourage employees to perform their tasks correctly and not to follow bad practices. Communication and cooperation between people should be encouraged.
- ✓ Involvement of the management: To promote an adequate safety culture, the involvement of the management is necessary. This should be the one that leads and sets an example in terms of prevention and good practices and should be the one that oversees rewarding good behavior and admonishing negligence.
- ✓ Training: The best way to ensure that activities are carried out correctly and safely is to provide employees with training. They must be competent, feel they have responsibilities and be aware of the consequences of their activities.
- ✓ Control of activities: Finally, you must control the activities, to check that they are carried out correctly.

To implement a Culture of Safety is a matter of education. We must ensure that people internalize the principles of safety. One of the measures that must be taken to improve the safety culture is to make people aware of why it is important to follow procedures and adopt good practices, as well as to encourage communication, participation and cooperation among employees. When we talk about the category of regulation, we refer to the whole process of carrying out a work, from the previous phases, to the conclusion of it. The regulation focuses on three moments: BEFORE, DURING AND AFTER, which must be analyzed and controlled. In this constant monitoring, we must analyze, above all, the set of intervening variables (personal, work, context ...)

The characteristics of the teaching - learning process for the development of strategic activities are:

- **Planning:** to plan an effective action we must analyze, reflect and evaluate previously, the elements that make up the work, the implicit personal factors and the environmental conditions.
- **Regulation:** during the execution of work, it is always necessary to control the entry and exit of information and its adjustments to the proposed planning, in order to optimize the results.
- **Evaluation:** the general assessment of the content of the work is indispensable. This includes the physical and mental activities that were presented during the performance of the work. The learning, the resources, the functionality, the adaptation, the alternatives, the strategies, the techniques used to draw conclusions, advantages and disadvantages are evaluated.
- **Cognitive skills:** in order to obtain strategic, effective and adequate action, the selection of a certain work technique must associate previous learning strategies that consider the factors involved.

Before applying a technique, it is necessary to identify the cognitive skills that we must put into practice such as: observation, analysis, ordering, classification, representation, memorization and evaluation.

Conclusion

The predominant factor in the working groups of the Northern Operation Unit is the lack of a safety culture in daily activity, probably produced by an induction at the beginning of the worker's adaptation process to the activity he performs, where training must be strengthened. EPMAPS, when carrying out construction and maintenance activities of sewerage networks, mainly in ditch excavation works, can generate accidents and incidents, especially of landslides and burial, which is why training and compliance with procedures must be considered as fundamental axes for prevention of accidents, a training based on the identification and evaluation of risk factors to which workers are exposed with new methods and strategies to effectively raise awareness of the worker's safety culture. The application of new training methods aimed at the worker induces the reduction of accidents and incidents taking into account the round-trip communication channels, always taking into account the experiences and the worker's need to apply the procedures in a better way and improve minimum response times for compliance with the tasks entrusted and customer satisfaction.

Recommendations

The personnel must take into consideration the adequate use of the assigned protection equipment for each activity, since there are no control systems at the source to carry out the work in external situations in which the behaviour of the place itself and the environment in front of possible control mechanisms cannot be known. Appropriate follow-up must be maintained to the application of the procedures, which prohibit or allow activities or works that are or cause possible accidents. The training to the adult worker must be coordinate with the daily activities assigned to each work group so that the continuous follow-up spaces must be maintained in order to consequently raise awareness in the adult worker of a safety culture in the tasks assigned.

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