

Education and the Future of Civil Engineering – Construction Site Issues: Knowledge and Workers

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Abstract

For Institutions of Education at High level it has been a real challenge to form the professional to act in the new work market. Nevertheless many Institutions have been searching hard for the best way to do so. Some of them have promoted new kind of curriculum more flexible and more adequate to the new student. One question remains: How to prepare the engineer for professional life? For some it is the internship that will provide the student the taste of what is to be an engineer. In Civil Engineer, the best way is also the internship at the building site if the choice of the student is to make constructions. This paper has as starting point the research in the construction section of the building site, focusing not only the engineer but also the worker and her/his learning process. It is in fact part of a research in Civil Engineering in a very deep analysis of its history in the construction of a city in Atlantic Forest Region. It is worth to stand out in this part of the research that the relation between learning and the workers' education level at the building site in Praia Grande city is approached through information picked in the workers' speech adding to the records of building companies. One of the most interesting aspect of this part of the research is that the "Know how to do" of those workers happens in the building site and it is part of a structure of occupations, in which unqualified workers apprehend an occupation side by side with more experienced workers. Another aspect is that a better education degree is fundamental in the absorption of new technologies that demand new productive processes and consequently a new profile of hand work in the building site is taking space. All these aspects together bring up the discussion about education in developing Countries in all levels, which demands the commitment in this case of civil engineering and workers segments in a first moment not to mention the political midst. No doubt at all that the whole society will feel the consequences of this big mass of unqualified workers facing the automation once more and now in construction field too. And for the Civil Engineering qualification and experience is fundamental in every level principally if the goal is to survive in the market. So the internship is one of the most valuable instrument to provide to the future engineer the experience.

Introduction

Let's examine all the aspects about the worker's performance and knowledge acquisition in a building site in order to understand her/him from inside of her/his educational, cultural and professional context at the building site related to the level of experience for the engineering student during the internship.

It was defined as objective of this work the relation between education and the workers' learning process at the building site. It is the "Know how to do", the low education level and the transfer of knowledge facing the innovations in productive process. The chosen theme is relevant once it is confronted with more general subjects, as: the incorporation of technological innovations and the demand for new qualifications and/or competences in de compass with the section of construction, whose workforce is absorbed in an intensive way and is characterized by the semi qualification and low education.

The contact happened initially with the interview of more than a hundred and thirty workers of the building site in three building companies in Praia Grande city. The obtained data should be analyzed carefully, because they are samples. It is interesting to notice that the observation and the collection of data was done in the urban context of Praia Grande city, in which the building site has fundamental role in the growth and embellishment of the city. In other words, to investigate the subjects involved in such context, the engineers and the workers of the building sites.

The workers in the majority have a low education and to whom the acquisition of a professional degree is not appealing due to the characteristics of the work, which promotes the professional marginalization and consequently the social marginalization too.

Continuing the research, it is important to investigate the education system, knowledge acquisition and the workers' learning process that are in the majority little educated and who learn the "occupation knowledge" in the building site. This aspect reflects a disagreement between technological innovations and the demands of a new labor profile in the building site.

The conclusion reflects central subjects of the approached theme, as well as, the investigations and reflections that were built along this study. This is important once this investigation provides to the future engineer information about a real work environment principally for those who will perform in construction field.

It is important to state that the main goal of this research is to try to provide to the students of civil engineering proper internships in building sites. The first step is to get in touch with enterprises and to establish a two ways road of communication in order to prepare the students for a work reality. No matter what new and how outstanding technologies can be used, the user is a human being who is part of a project.

It is essential to prepare the students for real work environment as well to prepare the companies to provide the students the valuable real experience. So it is necessary to show how much it worth to both (company and students) to have a chance to develop good real work in the building site.

Why in Praia Grande City? Because it is a city close to Santos that is growing fast where the construction is one of the most intense in the region and therefore has a large number of companies building houses, high buildings, clubs, resorts and etc. It is a fertile breeding ground

for the establishment of relations between engineering schools and enterprises willing the formation of future engineers.

Analyzing "Know how to do" and "Knowing How to Do Well"

In the context of the building site marked by the intense presence of a workforce of low education and little or no professional qualification there is an apparent disregard with the potentialities of those workers' formation in their multiple dimensions, mainly of the scholars knowledge.

According to the researches about the level of those workers' education, it was verified [1]:

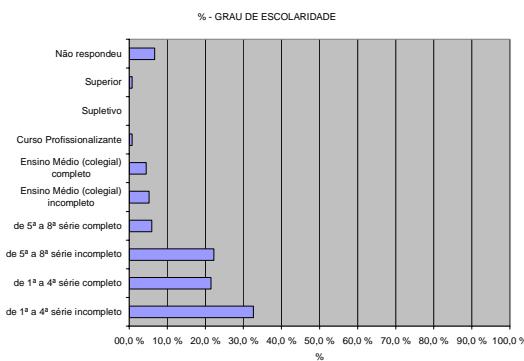


FIGURE 1 Scholarship degree.

The data above shows that 33% did not get to complete the 4th year of first degree, while 22% have ended the 4th year of first degree. Those percentages demonstrate that more than a half of those workers have low education degree. It is observed in the sequence that 23% did not end the 8th year of first degree and only 7% concluded the First Degree or Fundamental Degree. Among those workers 6% possess incomplete Medium Degree and 4% completed the Medium Degree, only 1% possess vocational course, 1% university, among the engineers of the site and 3% did not answer.

Once again it is necessary to consider that, differently of other productive sectors the building site lives together with the lack of professional perspective, so that it is difficult for the companies to make their workers study again. On the other hand, that perspective lack turns difficult to the worker to notice what are the "earnings" of her/his education as worker of the building sector.

In a "master's of works" words: "... I studied until the 8th year of first degree. To work here it is not necessary so much study, what we need is experience ... we have practice, we do well, we learn with the practice ... I didn't need the school, only the fact of knowing to read and to write ...".

Those depositions portray the "culture" type that permeates the world of the construction and that can be felt in the interviews with the workers about the continuity of the studies. In the obtained percentile only 10.4% continued to study, while 89.6% answered that they do not frequent any

kind of course. Among the 10.4% there are workers holders of an occupation as: plaster master, technical auxiliary and work with marbles and granites. It is important to point out a certain embarrassment of those workers when asked about the reason of their no return to the school. The return to the school many times means on one side, to assume her/his precarious domain of the basic abilities openly as to read, to write, to accomplish elementary arithmetic operations. On the other hand, that worker comes from an existence in which the request of the abstract knowledge, formalized at the school is very small [2].

It is the same her/his urban existence, once, because of the low education degree s/he looks for occupations that demand manual abilities and physical efforts and no abilities of how to read and to write. Added to this evaluation it is associated to the nature of the work, which demands manual abilities and a great physical effort. Besides, the schedule of the classes (evening classes) after exhausting working day results in fatigue that will interfere in the quality of the learning process. In a worker's deposition: "... here the work is very heavy, we enter at seven in the morning and we leave at five in the afternoon. S/he wants only to get home soon and to take a bath, to watch television to distract, to study won't change anything else ... s/he sometimes has another job after the work, to go to school is difficult ...".

The contact with many workers provided depositions similar to that and this leads to the conclusion that it seems to have a distance, a kind of incommunicativeness among the teaching process at the school and the work world, carting the motivation lack and the workers' cessation. On the other hand, when interrogated on the importance of the study in her/his profession 86.9 % answered yes – it is important and 84.4 % declared that they would take a vocational course. This shows that these simple men still see in the studies a chance of future opportunity in order to obtain better life conditions.

Among the interviewed workers, if they had the possibility to go to a professional course they would choose: 22% the course of electricity, 14% opted to be the person in charge of works, 12% bricklayer, tied with 7% dry construction, settler of marbles and granites and hydraulics, while 6% chose safety in the work. The other courses obtained less than 5%.

It is noticed in each worker's speech an anxiety as for the perspectives of the entrepreneurs' sensibility in supplying such courses. This is explained the difficulty that the sector possesses for the workers' ascension in the hierarchical structure of the occupations. A lot of times, that ascension feels not only for the capacity, but also, for characteristics difficulty to evaluate, such as the sympathy between the master of works and the worker.

About the researched builders' entrepreneurs it is verified that these do not understand or they do not want to understand those workers' anxieties especially because they are small, traditional enterprises and that even they are adapting to the new needs of the market.

What refers to the learning process in the context of the building site, some subjects deserve prominence, among them: How does the learning process happen in the building site? To what extent is "know how" of the worker related to the construction and the insight interpretation of meanings that are important to them related to their external relationships?

The learning process of the workers at the building site most of the time happens in the building site. In according to the interviewees 50% had her/his learning process in the building site, 17% learned with the family, 15% with the friends and 15% observing the day by day the stonemason, while 3% did not answer. Therefore, the learning process happens in the building site and it is part of a structure of occupations in which the master, the official and the apprentice interact. The process that aims the transfer of the "occupation's knowledge" has been destroyed once some activities were transferred to the outside of the stonemason and so the worker started to have the domain on a part of the product, as well as that "knowledge" has not been incorporated by the managerial segments.

The "Know How" is common denominator in all the processes of professional learning. Unqualified workers acquire her/his qualification working side by side with more experienced workers, while, the qualified workers make her/his road through companies enlarging experiences and occupying places of command as for instance, the person in charge of all works. The absorption of the knowledge and the worker necessity of learning as any other individual need to have internal incentives and it ends transforming them in according to their own needs.

Civil Engineering and Building site: Reflections about Education

In according to the deposition of some entrepreneurs, engineers and masters-of-works the work in the building site when accomplished satisfactorily seems to be the result of voluntary actions that emerge from some workers. How does that process happen? How some workers "know how to do" and "do well" and others not?

In this sense it is noticed that the learning of the work happens when some conditions are present. It is necessary to count with the good will to learn, to transfer knowledge and experiences. According to Mussak [3]: "The human being is an animal that learns and makes it during all her/his life. Everybody have capacity to learn, it is the concept that considers learning a phenomenon of receiving incentives, to process, to classify and to store knowledge with the purpose of creating a new consciousness of itself and the world provoking behaviors modifications".

Maturana states that "life is knowledge" [4], so the learning is a social and biological process and therefore it cannot be explained only by sociological perspectives, but also through those individuals' motivation to learn and to absorb knowledge. It is noticed that, knowledge belongs to any life form; it doesn't come from outside but in the way as the individuals organize their relationships with the external world. Therefore the worker in her/his learning process, introduces an order in what sees since s/he in a glance recognizes similarities, regularities and establishes what is more or less important. The process of assimilation of information does not depend on the assimilation quality but as how the information is seen by the intern's dynamics of the individual.

To understand the learning process and consequently "know how to do" is above all to speak about the construction of meanings. A worker only learns the content when it is capable to print in her/him a meaning. Therefore to "know how to do" or "to do well" is an individualized process of each worker, "through which intrinsic properties of the individuals' autonomy did not

capture the information of the exterior, but they welcomed their spills as interpretative phenomenon" [5].

The learning in the building site is a process of transmission of knowledge and experiences. The cognitive transfer among the workers happens as an accompanied mental process of the reflection/action that supposes that the worker is capable to recognize the techniques that are being taught and to recreate them in new situations. That learning process demands initially that the worker "wants to learn". Through an intuition more or less explicit that s/he has resources to invest in the understanding and in the domain of the learning situation based without a doubt, in a trust form in their own internal resources: I "can", I "want" and I "learn".

For the worker it is not enough to hear simply of other how to put tiles correctly and to follow that procedure precisely to act in an effective way. The capacity to integrate knowledge, the observation and the experience is decisive for "know how to do". It is the capacity to find, to select, to integrate the cognitive resources that s/he disposes.

The transfer of knowledge and learning mobilizes inference outlines of generalization, of resolution of problems, of reasoning, outlines those that are constituted very unevenly, according to the subjects. Nevertheless, "a universal competence" is not acquired by the simple transfer, but it is acquired through the experience and the reflection about the experience, the instruments, and the outlines or mental postures to facilitate it. It is noticed that the electrician's practice for instance in the building site is considered a specialized activity and it is noticed that the cognitive transfer is so immediate that it disappears as specific moment of the action and as problem. In that sense, the preparation for the knowledge transfer becomes just a "substratum" of the experience and complete practical-theoretical domain.

The concern of the cognitive transfer is worth above all for the beginner that should dominate knowledge through the practice of the reflection/action becoming a specialist or holder of a "knowledge of the occupation" after some time of assimilation and experience. It is noticed that the worker's occupation stands out for her/his capacity to relate and to transfer situations that as beginner judges to be the same because s/he does not notice the existent structural similarities under the several activities of a construction site. So what happens is that for the transfer of knowledge is necessary to unite the "know how" and the experience.

Any worker can simply learn giving a limited sense to the work and to the knowledge. "The transfer process becomes then unlikely if it is not accompanied by any of the representations that turn its usage imaginable and pertinent, out of that context of the acquisition" [6].

So when the learning happens with the union of the knowledge and of the experience the worker acquires "know how" or "to do well done"; on the other hand, when the worker simply learns limiting the knowledge and the experience what happens is "to do". It is the professional learning the best example of "learning to do", in which the workers learn with other workers, before even they can understand rationally what they are doing and the reason they are doing. It is noticed, that in the professional activity a lot of learning process of new competences depend on the imitation of the beginner worker observing the activity developed by the occupation worker.

According to Shon: "... the imitation is more than a mechanical pantomime; it is a form of creative activity. If I have to imitate the skilled action of one of you, I have to understand what there is in its essence. But the essential elements of your action do not appear identified as such. The trivial and the essential are mixed: that is why the disciples have tendency to imitate her/his master's ways of doing. When I imitate you, I try to build what I understand the essential of your action and to test my construction when carrying out of my own the action" [7].

So the beginner worker tries to rebuild what learned as essential with the other worker and try acting through her/his own creative action. To learn it is important to understand the sense of what is learned. For such, it is not enough the "knowledge" to be intelligible and assimilable. It is necessary that the worker understands why it was developed, transmitted and why it is convenient to acquire it.

The perception of the necessity of acquisition of knowledge by the construction worker happens in the "praxis" of day by day. Her/his understanding is utilitarian once, the learning of certain "know how" allows to transfer and to recreate them in new demanded techniques and consequently to guarantee her/his survival in the job market. An example of that happens with the use of bricks and of the wizened plaster. In both cases the measurement of the perpendicular in the rising of a wall is similar. It is noticed that in the wizened plaster, the adopted technique is to use the previous experience added to knowledge of new type and experience. It is, therefore, in the knowledge of a new technique that the worker acquires a new "know-how".

It is obvious that, a level of higher education presupposes more organized forms of thought, therefore, more advanced levels of learning, making possible larger adaptation to the abstract and sophisticated forms of personal and professional relations and consequently success in those incursions. So the educational process, in any degree or purpose, always involves the cognitive capacity, because it is through it that the individuals solve their problems and they set out solutions that are fundamental pre requirements for the acquisition of new knowledge about the nature, the culture, the work and the society.

New Technologies and Workers: Some Discussions about Human Relations in Building Sites

For Institutions of Education at University level it has been a real challenge to form the professional to act in the new work market. Nevertheless many Institutions have been searching hard for the best way to do so. Some of them have promoted new kind of curriculum more flexible and more adequate to the new student. One question remains: How to prepare the engineer for professional life? For some it is the internship that will provide the student the taste of what is to be an engineer. In Civil Engineer, the best way is also the internship at the building site if the choice of the student is to make constructions.

No doubt that at the building site the student will get in touch with the worker who will make the hard work. It is when the future engineer has the impact of different cultures in the working environment. It is may be one of the most valuable experience for those that will be involved in projects of building house, buildings, bridges or power plants. It can provide the students the

dimension of building anything and how important is the good hand work, how to take advantage of new technologies and how important it is for safety.

New Technologies helps to accomplish a better work but still men are in charge of new technological devices. New technologies demand more qualified people and so more educated. New Technologies in 21st Century is far more sophisticated and so the apprentice requires more formal education. It is the new reality that common men have to face as well as any professional of any field. For civil engineers the contact with workers is part of her/his formation in every level. No matter what is the size of a project the human element and the relationship in internal or external to the project is very important in a daily basis for the accomplishment of it.

The education has proved to be valuable once it altogether with experience form a better worker and a better engineer. Although high education is preached by politicians and the society it is far the accomplishment of at a higher rate of people with high education in the Country. It is due to the social, economical and political situation that does not propitiate the adequate number of universities and the possibilities of payment by the students. It is the result of a historical and complex process of a young nation.

Final Comments

This part of the research had as the starting point the study of the workers' education and learning process at the building site in Praia Grande city. In this way, the debates about the productive restructuring, in the need again of a new worker's profile with higher education degree are just incorporate in speech level and not in practice.

Having as support the data of the present research it is possible to conclude that, most workers did not complete the 4th year of first degree. That fact leads to the conclusion that the lack of perspective for the workers and that education increases a little or nothing her/his professional life have collaborated for the current situation. Other factors stand out the education policies presented to adults in this country is very bellow the standards of the needs of present world work market, mainly in an activity that demands much more ability of movements and physics force than how to read and to write.

As an outstanding characteristic of human being is the capability to adapt such as those workers smuggled of the education process learning in the day by day with other workers. Therefore, "Know how to do" is passed to the other in a relationship of "learning to learn" and they are common denominators for those construction sector's workers. The learning process is inherent to the human being, while competences and abilities are potentially capable to be developed. The worker cannot understand the chemical processes that contain the materials and components of the building industry but s/he adapts (and s/he will adapt in the future) to the "know how to do" independent of the productive innovations.

For Civil Engineering students it is important to understand and to make use of information about construction work environment and everything that is related to the human element with whom they will have to deal. The goal is to prepare the students in such a way that they can perform at the building site in every level becoming an important element in the dynamic of

construction for the building company. It is a way to create a space for internships for civil engineering students at the region and also internships that worth to go for both companies and students.

Finally, the study of the learning process and building site workers' education are justified in the social debt not repaired and what concerns to the new generations, so that the adults of the future have conditions to compete at the professional market in equality of education and social conditions. It is not an easy task taking into account the dimensions of a large Country an ex colony with a young population of almost 170million inhabitants.

Automation is there and sooner or later the building companies will have to face the need of more qualified worker and the Country will have to face the social and economical impacts of such changes. To mobilize the professional sector of civil construction in every level is imperative and necessary to overcome the challenge of the new labor market for the sake of the society as a whole.

References

- [1] H. dos S. Alves Trabalhadores do Setor de Edificações na Cidade da Praia Grande: Escolarização, Aprendizagem e o Saber Fazer. In: World Congress on Computer Science, Engineering and Technology Education, Itanhaém, 2006. New Engineering to a New World. Itanhaém: WCCSETE, 2006. p. 1457-1460.
- [2] C. C. Fleury; N. Vargas (orgs.). Organização do trabalho: uma abordagem interdisciplinar, sete casos brasileiros para estudo. São Paulo: Atlas, 1994.
- [3] E. Mussak Megacompetência : uma nova visão do trabalho e da realização pessoal. São Paulo: Gente, 2003.
- [4] E. P. Gonçalves (Org.). Educação e grupos populares: temas [re]correntes. Campinas: Alínea, 2002.
- [5] H. Maturana; F. Varela. A árvore do conhecimento. São Paulo: Psy, 1995.
- [6] P. Perrenoud Pedagogia diferenciada: das intenções à ação. Patrícia Chittoni Ramos (trad.), Porto Alegre: Artes Médicas, 2000.
- [7] Nóvoa (coord.) Os professores e a sua formação.Graça Cunha et al. (trads), Nova

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