PERCEPTIVE POWER TRAINING FOR FUTURE CIVIL ENGINEERS

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Abstract

The goal of the paper is to point out the value of methodology, especially observation method for the development of perceptive power, and especially for civil engineers. Working with a number of students at the Polytechnic Graduate Study of Civil Engineering we detected certain "construction site methodology problems". A segmental, dissected approach, caused by an inadequate, non-systematic observation, is the result of not knowing the observation method, and thinking that the goal and results mean the same thing. The goal of every job is equal to the method and is equal to the way to final results. Precisely for that reason the civil engineer has to use all of the three observing positions, those of the "observer", the "observer-participant" and the "participant-observer".

With a sensibility training technique we integrated work groups, or T-groups, established full professional communication, articulated the sources of information, defined the specific problems of each individual student, and finally deducted conclusions through group analysis.

With a perception test we determined the state of perceptive power of each individual student, the degree of information, and the sources of information. At the end we asked each participant for a final thesis with a real-life problem as a summary of the group work and sensibility training.

The whole process took place on the courses Communication Skills, Methodology and Management in Civil Engineering, and Construction Organisation.

Key words

Degree of information; dissection; observation method; perceptive power; sensitivity training; sources of information

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1 INTRODUCTION

There are two main viewpoints on the problem of observation, and for a layman they are mutually exclusive. For an objective observer, a scientist, the mentioned viewpoints on the problem of observation make for a paradox of some sort.

First viewpoint talks about different worlds of different observers, i.e. every human being lives in his/hers own world, and that world is what each human being notices (feels), thinks and experiences.

With the globalization in which the corporation is a subject of cognitive processes, but is also an observation authority, the feelings, thoughts and experiences of individuals and social groups converge towards a single image of the world we live in.

Second viewpoint, as a state, was an ideal of some sort, an aspiration of authoritarian ideologies, manifested through a company of socialization and on the other hand an ideology of capital articulated through a motto of civilising the uncivilised people and tribes.

With the loss of confrontations of mentioned ideologies, the globalization imposes itself stronger and more intensively as one of contradictions which is hard to situate as an inner-organisational, either as an outside limitation of corporation functioning. The mentioned problem can be articulated through questions which are imminently imposed: "How to stimulate differences in observations if observers have a more and more similar, or even the same image of the world around them?", or "How to avoid social deconstruction, social disorganization of "outer" and "inner" social context of an organization?". Most of the successful corporations face the mentioned paradox and ask themselves "How to manage it?". Global societies also meet the same problem. The social dynamics with social groups does not miss the individual also. Often because of their personality character attributes, and also because of the structure of societal and manufacturing relationship, the individuals cover-up their "perceptive disability" with a frustration defence mechanism (psychoanalysis) states Cattel et al. in [1].

2 GOOD OBSERVER OF UNTYPICAL SIGNALS

The mentioned contradiction is best expressed by Max Weber in his known statement of "Rationalism without reason" which reaches its peak in irrationality and is questioned as a rational installation. According to Weber in [2], the resolution of inner contradiction is managing and coping with paradoxes, which is in a certain way a socialization in a corporation structure.

Instead of analysts who search for certain data, we rather think of an observer who looks for unusual signals says Levitt et al. in [3]. Space, time, structures, objects, movements, changes, expressions and quality of power as a basic dimension of noticed world. The "eyes" of a geologist, geo-expert, construction specialist, architect, building constructor, the "eyes" of a construction site engineer, and the sharpened perception of all participants of the construction industry, enable the perception to be adopted and developed in students and civil engineers. In what way to develop a vibrant communication between different observers of the "same world" – the building construction?

On the Civil Engineering Department of the Polytechnic of Zagreb, the problem of perception of each of the mentioned dimensions, watched from a specific angle by the professional "observing" eye, is leading to synthesis, the whole, a future to-be engineer, manager, competent for communication with all of the construction process participants.

Perception is vital for the art of communication and management for civil engineers in technical as well as in social sense of civil engineering practice. From investments to design, build, and at last the use of materials and the buildings themselves.

Observation of the relations between the whole and its parts, the relation between the individual and the group, the sizes, textures and structures of materials, interaction, etc., is unavoidable for the functioning of civil engineers on construction sites. The expression and shaping with words and sentences, materials, but also the forming of the materials themselves (industrial design) is a space in which a civil engineer directly or indirectly moves every day.

3 STUDENT FIELD PRACTICE

The next step in the development of the observer is field practice, the practice of confrontation and searching for unusual signals, and the facing with paradoxes of socio-technical and social context inside a construction organization. The "eye" of a civil engineer and a work organisation sociologist searches for "unusual" signals in action, in the mutual influence and feelings (Hare et al. [4]), in preferential connections (Moreno [5]), in the ways how employees take and adopt information from the socio-technical context in which they function. That then affects the behaviour, openness for new knowledge and motivation for learning (Asch [6]), and the behaviour of humans which is conditioned with the field of mutually dependable psychological and social forces (Lewin [7]) and with the defence mechanisms guarding from frustration (Freud [8]).

The goal is to develop talents of individualized perception, or to develop attention and consciousness for differences between individuals, and all that to avoid confrontations and develop communication, cooperation, and the consciousness of mutual goals. In other words, the behaviour, negotiation, and problem resolving all depend on the way how we see – percept, it depends on the way in which we register the observed data, and in the end depends on the interpretation of material and data we collect.

Students on the Professional Study Programme of Civil Engineering (3 years – 180 ECTS) on the Polytechnic of Zagreb attend field practice twice during the course of their studies, and for a total duration of two and a half months. Students on the Polytechnic Graduate Study Programme (2 years – 120 ECTS) on the Polytechnic of Zagreb do not attend any field practice, but are usually already employed in construction companies and already have some experience in civil engineering practice.

In the field practice for students the status of the observer is "observer-participant", who keeps a diary of his field work and acknowledges all the important processes and events, the behaviour of participants in every single day. The position of a student of the Polytechnic Graduate Study Programme (who already graduated on the Professional Study Programme) is significantly different from that of a student of the Professional Study Programme attending field practice. The already graduated students have a formally defined working role, a role of construction site manager or its assistant, and construction workers do not see them as "observers" or "observer-participants". Nevertheless, all civil engineers employed in the construction industry are in an undefined status of "observer-participant", which enables them to obtain (through their long period of stay on the construction site) "unusual" signals, because the workers accept them like "their own", like a part of their work group, an "insider". The paradox is even greater because a large majority of civil engineering entrepreneurs do not accept civil engineering students on field practice, so that the students could easily obtain information and notice the "unusual signals" occurring in the organisation of works on the construction site.

4 T – GROUPS, SENSIBILITY TRAINING

With a group of Polytechnic Graduate Study Programme students (already graduated on the Professional Study Programme) and during the 2011/2012 academic year, we have tried, through conversation, to bring each individual to ask and to answer some basic questions like: Who am I really? What are my virtues and flaws? What are my needs and values? What is my power? What do I have on my disposal for the realization of that power?

We tried to achieve all of this through lectures on the course called Communication Skills which is compulsory for all of the students on the Polytechnic Graduate Study Programme.

Through the answers on the mentioned questions, each participant has to know his possibilities, which he can realize in his work surroundings, and has to establish the relation between his needs and demands and the employers expectations. He also has to see how to integrate with creativity in any social surroundings and situation, and how to create a quality social interaction, and social network (according to Bradford in [9]). In a T-group the sensibility training is conducted in a way that each participant introduces himself through an example of a "real-life" construction site situation, which involved communication between his superiors and subordinates in resolving certain problems. The successful and unsuccessful resolution of problems has provided the individual, with a help from all participants, to answer the fore-mentioned questions. We had a group analysis and searched for solutions, and also the mistakes in behaviour and communication were pointed out to students. We had a success in creating an atmosphere in which almost all participants have relived their colleague's situations with great emotion and intellectual strength. High degree of identification, participation, and true human compassion was occurring even during the breaks between classes. All of the participants opened up to their classmates and have confided with them, that the working climate even had some signs of psychotherapy.

It is needed to mention that the sensibility training had lectures in communication skills before it so that the teacher always introduced himself through his attitude towards each problem, or his attitude towards the participants, and his attitude towards the "message", in that way showing the need for a direct feedback information. In that way, the "perceptive training" was happening before the "sensibility training", and it showed that the differences in observation are merely the assumptions needed for cooperation, good communication and problem solving, and not for confrontation and running away from problems.

Sensibility training took place through three levels: on the first level individual problems were looked at, then behaviour, and students learned how to communicate, express themselves, listen and acknowledge each other; on the second level groups are being built and strengthened, group dynamics developed, and work is done on team problem solving; on the third level inter-group relations are developed, problems common to all are being searched for, and at last the problems are being solved (according to Bradford in [9]).

In the next chapter, we give the pilot research results of perceptive power training for Professional Study Programme graduated civil engineers that studied on the Polytechnic Graduate Study Programme during the academic year 2011/2012.

5 PILOT RESEARCH OF PERCEPTIVE POWER TRAINING

5.1 Problem of the pilot research

Perception and observation are processes with which the brain organizes data that came from different senses and interprets them making a whole which makes sense. The perception can be a method of observation, a tool, an instrument, but also it can itself be a subject of research. Lately the problem of industrial design is imposed to civil engineers; it is imposed both directly and indirectly from developed countries and directly through investors and designers says Quarente in [10].

Rich investors have become a source of information, not only for civil engineers, but also sometimes for designers. In the time of great civil engineering "boom" there was a lively communication between information and the use of new materials.

With the economy crisis, and then with the minimization of civil engineering industry, the degree of information has dropped significantly, and that happened with the decline of importance of perception as a research method and as a skill in everyday life.

The aim of the pilot research

- To establish the sources and the degree of information of civil engineers on the Polytechnic Graduate Study Programme
- To test the perceptive powers of civil engineers
- The attitude of civil engineers towards industrial design, the form and visual expression of building materials

Working hypothesis: The group of tested civil engineers is a homogenous professional group regarding information, perceptive power, and regarding industrial design of new materials.

Accessories: give each of the tested individuals three samples of different building materials

- Sample of perforated graphite polystyrene (Figure 1)
- Sample of central heating installations (Figure 2, 3, 4)
- Sample of plumbing installations (Comisa PE-RT Typ II)

Fig. 1: Sample of perforated graphite polystyrene

Fig. 2: Sample of central heating installations

Fig. 3: Sample of central heating installations – joint detail

Fig. 4: Sample of central heating installations – cross-section detail

5.2 Procedure

Sample group of 88 tested first-year students of the Polytechnic Graduate Study in the academic year 2011/2012 was not differentiated by sex, age, position inside the company they are working in, specialization, employment, all because of the character of the questions.

The conditions and circumstances of the research

The research was conducted during the classes of the course Communication skills over a duration of 90 minutes. Scoring of the results, commentaries and discussion made the motivational element of the work [11].

Tasks

- What is the purpose and function of given samples of building materials?
- Describe in detail the given building materials.
- How important is the texture, look, shape, and final finish/quality of the material given to you?

The results

First task: The sources and degree of information of tested students of the pilot research, about the purpose and function of given building materials.

From the data collected we executed a differentiation of tested students in roughly three groups, the "informed", the "uninformed", and the ones "assuming" and giving the correct answer.

For the "informed", the sources of information sorted by significance are:

- Investors – designers
- Designers – construction companies
- Internet
- Construction equipment fairs and seminars
- Formal educational process
- Leaflets and commercials

For the "uninformed" and the ones "assuming" and giving the correct answer, the sources of information sorted by significance are:

- Formal educational process
- Internet
- Leaflets and commercials
- Designers – construction companies
- Construction equipment fairs and seminars
- Investors – designers

What is important to mention is that in the structure of the groups of the "uninformed" and the ones "assuming" and giving the correct answer, the majority of the students are employed in companies which are not "stable". In that group you can find people employed in other trades and not in civil engineering, the unemployed and a group of tested students which are in a period of their employment contract termination. From the mentioned facts we can come to a conclusion that the group of "informed" students are working in stable civil engineering organisations. In that group of tested students on the list of sources of information are the investors – designers.

Second task: Describe in detail the given building materials

The group of "informed" students mostly gave systematic and full descriptions of given building materials. Their proactive behaviour is compatible with the managerial proactive behaviour in the company in which they work, which is extremely influential for the future development of young engineers.

Somewhat different situation occurred with the tested students whose companies and/or management acts reactive, and also with the students who are unemployed. The description lacked some vital details like holes for the control of proper joining of plumbing and central heating installations. Also they did not mention or emphasize the special technology of joining the elements. With the mentioned group of students an unsharpened power of observation (or perceptive power) can be seen, and the lack of a systematic observation is also noticed. In one small number of tested students (mostly unemployed or employed in other trades) it can be seen that they have a different perception of the given materials. The perception in a sense that important characteristics are overlooked and insignificant and random characteristics are emphasized. For example, in the description of the piece of graphite polystyrene, the cut and dimensions of the piece are given, and the importance of perforations or the type of material is skipped. We can conclude that there is a positive correlation between the degree of information and the source of the information. It is interesting to emphasize a dilemma: Did the perceptive power of the "informed" tested students increase with the degree of information, or is the degree of information a consequence of the development of the skills of perception? It is certain that the tendency to observe along with good sources of information and exercise lead to the skills of observation.

The task of the educational process is to exercise the skill of observation, to better allow the receiving and storage of data, and the information substrate would then influence back the development of power of perception. This dynamic process enables the making of a programme, but what is even more important the speed of change and the speed of creation of new programmes which are efficient in this new situation according to Gagne et al. in [12].

Third task: Problem of design of the given building materials

We categorised the students based on their answers into three groups:

- Students who were stunned and confused with the question of design
- Students who knew what is industrial design, but thought that it was not important for the building materials
- Students who thought that the industrial design is important for the production of building materials in a sense of a special way of communication and information about the product

The category of tested students who exclusively prefer the function of the building material over its design is extremely existentially and pragmatically focused, which without a doubt corresponds with the state of their construction companies, and building designs which are an expression of the capabilities of the investor. The mentioned group of students think it is nonsense to design materials which are covered and cannot be seen in the final stage. Those tested students cannot assess the fact that the design can in a functional or aesthetical sense be valuable, no matter is the material visible or not after it has been built in.

On the same questions, the first-year students of the Polytechnic Graduate Study in the academic year 2013/2014 give almost identical answers. One atypical answer must be mentioned *"…it must be mentioned that all of these materials, although not visible after built in, look very good in comparison to materials of older generations. Also the quality and characteristics of these new materials are far ahead of previous generation materials."*

6 CONCLUSION

With this pilot research we dismissed the working hypothesis about already graduated civil engineers now studying on the Polytechnic Graduate Study as a coherent and homogenous professional group. The pilot research indicates the significance of feedback information, experience attained in field practice/experience of students – civil engineers, and the problems they experienced in civil engineering industry. The feedback information is of great value for full professional communication in the formal educational process as inside working organisations/companies. In future researches it would be significant to take into account some of the discarded characteristics which could differentiate the students in more detail, like sex, age, employment status, working position, formal or informal education. Also the details on the companies involved could also be taken into account, like the number of employees, qualification structure, communication, specialization inside the civil engineering branch, management style, ownership, etc. In the course Communication skills on the Polytechnic Graduate Study we are trying to work on the increase of perceptive power, the skill of observation and information, and all for the purpose of better communication. With the increase of perceptive power of students on the Professional Study Programme and the Polytechnic Graduate Study Programme we would certainly get a higher level and more objective grades on the classes taught, which would decrease the dispersion of grades surrounding the mean value. The problem of perception was researched by psychologists (experimental) mostly in the USA, by educators, by social psychologists and sociologists. They did that in education of military personnel, industry employees, and not so much in the educational system. The methodology of the mentioned sciences has highly developed methods for skills of observation, but also methods for scientific research.

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