Cognitive and Environmental Analysis of the Engineering Teaching - a Case Study in Four Subjects in a Civil Engineering Course

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Abstract: This paper analyzes four subjects from the Civil Engineering Course at Ponta Grossa University, Paraná State, Brazil: Civil Construction, Paving, Materials Mechanics and Hydraulics. The analysis of the subjects considered some cognitive aspects, related to environmental aspects. The analysis in all cases was done through the observation of a lecture of the subject, complemented by questionnaires which were answered by teachers and students.
Considering some cognitive aspects, the teachers were analyzed. Having in mind the constant evolution of the new technologies, the teachers made a self-analysis about the need of searching new knowledge to transmit to the students, and about their performance related to this matter.
Considering some environmental aspects, the illumination, the noise and the temperature were analyzed in each case. The teachers and the students answered the questions evaluating how each one of those factors helped or disturbed the transmission and the reception of information.
The link between the cognitive aspects and the environmental aspects is the influence that the environment has on the teaching process, affecting the reception of the contents that the teacher has searched. As important as knowledge and new technologies is an adequate environment, creating a proper atmosphere and not disturbing the process.
The final purpose of the study was the elaboration of a list of suggestions that may be implemented in the analyzed subjects, always thinking about the improvement of the quality of teaching in the Civil Engineering course at Ponta Grossa University (UEPG).

Keywords: environmental analysis, illumination, noise, temperature, engineering teaching.

1. Introduction

The teaching process is affected by several factors. Some of them affect it meaningfully, and can disturb it in a high degree. They are the environmental factors, such as illumination, noise and temperature. They always happen surrounding the teaching process, but their influence is felt disturbing the transmission and the acquisition of knowledge.

1.1 Illumination

An important condition to the teaching process to happen successfully is a good illumination. Knowledge that the teachers pass to the students has an important visual component: written materials on paper sheets or written words at the blackboard. Fialho & Santos state that illumination is a variable which is divided only in two situations: sufficient or insufficient [1]. A bad illumination will not allow the correct contents apprehension.

1.2 Noise

Another important condition to the teaching process to happen successfully is the silence. Knowledge that the teachers pass to the students has an important auditive component: the words he says. A noisy environment will not allow a perfect contents apprehension. Fialho & Santos say that a noise can be uncomfortable to the execution of a task that demands concentration, even if its level is not too much high [2]. Dul & Weerdmeester affirm that noises

in the workplace disturb, cause interference in communication and reduce concentration [3]. Grandjean declares that ear sensibility to a certain sound decreases with the growing noise level [4], and completes asserting that thinking and reflection in a noisy environment tire more than in a silent one [5].

1.3 Temperature

Another important condition to the teaching process to happen successfully is the temperature. If it is too hot or too cold, the student will not be totally able to apprehend the contents in a correct way. The student will feel uncomfortable and will not pick all the transmitted knowledge up. This situation is bad to the teacher, too. Fialho & Santos tell that a meaningful loss of attention can be verified in a temperature higher than that of thermal comfort [6]. Grandjean compares a hot and a cool environment, arguing that high heat leads to fatigue and to sleepiness, reducing the readiness to answer and increasing the tendency to faults [7], while if the human body is menaced by cooling, there is a need of activity increase, and the attention and concentration are also reduced [8].

2. Observation

Four lectures were observed: two of then were related to theoretical lectures (Civil Construction and Materials Mechanics) and two of them to practical lectures, in laboratories (Paving and Hydraulics).

Both the theoretical lectures were alike, with an oral speech complemented by overhead transparencies and by paper sheets containing written texts and exercises. The teacher sometimes wrote at the blackboard, when an important content had to be stressed.

Both the practical lectures were alike, too, with data registering and phenomena analysis. Data schedules were filled at the blackboard while the students filled their schedules in paper sheets.

The illumination in all cases was very good, judged as enough to the intended activities. Theoretical lectures took place at rooms surrounded by six big windows (3,00 m X 1,20 m) and have twenty 40 W fluorescent lamps. The laboratories where practical lectures took place are surrounded by nine big windows (3,00 m X 1,20 m) and have sixteen 40 W fluorescent lamps.

As for the temperature, there was not any aid, if necessary. The temperature was pleasant at the observations days, but when the weather is too hot or too cold, there is not anything to do, except opening or closing the door and the windows.

About the noise, the UEPG Campus is located around 10 km far away from Ponta Grossa City downtown, in a calm and green place, surrounded by too much grass and many trees. The only noises that can happen are from cleaning, construction or maintenance services outside, or people circulating or standing by the corridors, talking in high volume. During the observation days, there were no services outside, and few persons were circulating or talking, whose noises did not disturb at all.

3. Questionnaires

The four teachers and thirty students answered to a questionnaire, speaking about the influences of the environmental aspects on the teaching process, and the way they can disturb it. There was not a quantitative worry about percentages. Many answers were alike, and some of them were chosen as the most meaningful ones, in order to illustrate the opinions in a general way.

3.1 Knowledge

Some opinions were listened from the teachers, about the need of being updated about new knowledge, in order to transmit new contents to the students:

- the teacher must transmit all new contents to the students, so that they are able to face them and to work with them;
- the pedagogical formation must change, or it will graduate unprepared professionals;
- it can be observed a fast technology evolution, and the teacher must study it;
- the teacher must search the information and make it possible to the students to find it too.

3.2 Performance

Some opinions were listened from the teachers, about their performance in searching new information:

- one of them goes to related events and programs technical visits to construction sites;
- another one looks for information about the construction of the scientific spirit of the student, although he recognizes that his daily actions still do not show these reflections;

- another one looks for actual and new information, although she recognizes that there is a limitation, related to the embracing of many other activities.

3.3. Illumination

Some opinions were listened from the teachers, about the influence of illumination in the teaching process:
- when a curtain is lacking, there are reflections in the blackboard;
- the illumination by windows in both right and left sides of the classroom, together with a bright blackboard also causes reflections, disturbing the reading;

Some opinions were listened from the students, about the influence of illumination in the teaching process:
- the illumination by both left and right sides helps both right-handed and left-handed students;
- bad illumination makes visibility difficult, leading to an effort, impairing performance and increasing mental fatigue;
- bad illumination makes instruments scales reading difficult, leading to mistakes.

3.4. Noise

Some opinions were listened from the teachers, about the influence of noise in the teaching process:
- noises distract the students, which can not listen to the teacher;
- some classrooms are at the side of great traffic corridors, causing disturbs to the class.

Some opinions were listened from the students, about the influence of noise in the teaching process:
- noises inside the classroom disturb more than external noises;
- students conversations are the most common source of noises inside the classroom;
- noises impair understanding, attention and contents assimilation;
- noises become irritating after some time.

3.5. Temperature

Some opinions were listened from the teachers, about the influence of temperature in the teaching process:
- the kind of roofing tiles (amianthus) is not the most appropriate to hot days, leading to high temperatures inside the building;
- hot environments or environments with little air circulation are uncomfortable;
- cold environments are bad to the students, who sit down for long times, without moving;

Some opinions were listened from the students, about the influence of temperature in the teaching process:
- heat is uncomfortable and impairs attention;
- when it is hot, it is hard to concentrate;
- high temperature suffocates the brain; cold temperature freezes it.

4. Suggestions to the teaching process improvement, listened from the teachers:
- variation in the form of contents exposure, using didactic resources that don tire the students;
- teaching through seminars and group activities;
- use of real situations, found in practice;
- building a living place to the students would take them far away from the corridors and from external sides of classrooms;
- good curtains will eliminate reflections in the blackboard;
- painting the blackboard with a tarnished ink will also eliminate reflections in the blackboard;
- putting electric fans in the classrooms will decrease heat in hot days.

Suggestions to the teaching process improvement, listened from the students:
- cleaning, construction and maintenance works should not be made during classes time, because they are important sources of external noises that disturb the teaching process;
- reprehending talking students can decrease the amount of internal noises.

5. Conclusions

The teaching-apprenticeship process, particularly in our case the Civil Engineering teaching, is fundamentally based on the knowledge transmission. Firstly, the traditional contents that are inherent to the professional career, so that the graduating student be able to work with the basic necessary information.

The teacher, however, must be alert to the new technologies evolution, in order to transmit to the students as much new knowledge as possible, to complement their formation and to update them to the new market requirements.
The teacher may also indicate and orient this search, being more than just a knowledge transmitter, and becoming and apprenticeship facilitator.
But all this contents, knowledge and information transmission must happen in a favorable environment, in order to have success. This environment must help and not impair the process. Simple precautions can be taken so that the main characteristics that can impair the comprehension (as for example illumination, noise and temperature) are placed in appropriate levels, acting in a positive way in the cognitive process.
When these factors are not appropriate, they will impair the teaching and the apprenticeship processes. If they are appropriate, they may even not be perceived, but they will be too much important to the process harmony.

6. References

[1, 2, 6] F. Fialho and N. Santos, anual de an婿ise ergon獵ica no trabalho", 2ª. ed., Genesis Editora, Curitiba, 1997.

[3] J. Dul and B. Weerdmeester, rgonomia pr嫪ica", trad. I. Iida, Editora Edgard Bl her Ltda., S綏 Paulo, 1995.

[4, 5, 7, 8] E. Grandjean, anual de Ergonomia - adaptando o t rabalho ao homem", 4ª. ed., Editora Artes M 嶸icas Sul Ltda., Porto Alegre, 1998.