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CONSTRAINTS IDENTIFIED IN TECHNICAL COMMUNICATION IN THE ONLINE ENVIRONMENT – A CASE STUDY APPLIED TO ENGINEERING STUDENTS

Bucur Mihaela[1], Ban Andreea-Romana[2]

[1,2] *"George Emil Palade" University of Medicine, Pharmacy, Science and Technology of Târgu Mureș*

Romania

[1]mihaela.bucur@umfst.ro
[2]andreea.ban@umfst.ro

Abstract

The present paper presents the conclusions related to the approaches in which the online learning on the topic of technical education has influenced the quality of the way the information is conveyed. The paper presents a case study on a group of 10 students from each specialization of the Faculty of Engineering and Information Technology within the "George Emil Palade" University of Medicine, Pharmacy, Science and Technology of Târgu Mureș, approximately 10 months after the teaching activities have taken place exclusively online. The conclusions refer to a number of rules specific to technical communication and how they are used by the facilitators, namely by the teachers. The purpose of the paper is to identify the constraints related to the online environment, in the event that this system is practical and useful to future engineers as well

Key words: online learning, case study, technical communication, rules in technical online communication

1. Introduction

Computer-mediated communication facilitates the communication of messages through computers. In engineering practice, they are mainly used for data, especially for processing and storage. The pandemic forced even the world of higher technical education to carry out classical teaching activities with the help of the Internet, which became the new way of presentation and communication. Thus, didactic information contains more and more references generated by hyperlinks, multimedia presentations which include less text and more images and animations, often accompanied by sounds.

From carrying out complex laboratory work, to conducting seminars on the basics of technical drawing, the new teaching methods must be adapted to a fundamentally different way, much more complex, ideal and more efficient, but not at all convenient for teachers who are resistant to change.

Although the potential for transmitting technical information must be used to the maximum, there are a number of dangers related to the fragility of this type of didactic communication. As Bowen [3] said, there are also a number of technical restrictions, which are turning out to be more and more suffocating both for specialists, but especially for those who are facing this type of communication for the first time.

Frequently, the volume of information or traffic speeds are much too high compared to the existing capacity of the infrastructure owned by both the transmitter and the receiver. Among the problems identified after almost a year of technical education exclusively online, the impossibility to open some files, to share them, the clarity of the sound represent only some shortcomings, to mention but a few.[5] As Direito, I. & all (2012) showed, in the long run, online

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communication methods in technical education can raise some problems related to increasing work productivity, active participation of future engineers in team projects, the way they aquire new knowledge.

2.Theoretical Perspectives

At first there was a clear need for assistance and guidance, and this can be an important step for both students and teachers who seem to have adapted a little harder [6],[7]. Written communication, which sometimes replaces verbal communication, brings along a number of other elements related to spamming, spelling mistakes, inappropriate language, exaggerated abbreviations or even the unrecommended use of emoticons. Our study also identified a series of situations in which too specific technical vocabulary was used excessively, other times there were elements of jargon, personal comments, but also situations in which teachers effectively developed the art of logical argumentation and made themselves understood.[8]

We have identified a series of rules that should be followed by the information facilitator, who is practically the teacher or laboratory worker. We have evaluated these rules in terms of the students who took part in the study:

1. The precision of the conveyed information. Future engineers must be logically trained, because they will work in extremely precise fields since they are the people who show enthusiasm and intelligence due to the chosen specializations. For this, the way these information is transmitted must be extremely clear, logical and algorithmic.

2. Focus on students. Perhaps the texts of the specialized manuscripts are extremely sophisticated and aimed at a specialized and extremely limited audience. However, when there are communication barriers specific to online education, all this information must be adapted to be simple and easy to understand for students. Perhaps the first question that the teacher has to ask is who reads the text which has been sent online and how well it can be understood. Every online speech has a certain audience. The subject must be adapted to the students' level of knowledge according to each year of study. Some technical abbreviations or acronyms that are easy for specialists to understand may need to be explained more clearly to students. For example, the performance of a CNC machine or the methods specific to quality management can be easily expressed through measurements, graphs, tables or diagrams, the information can be expressed simply and clearly and thus they can understand it more easily.

3. Elimination of superfluous information. Maybe words like power or couple help more in the communication of specialists, but it must be adapted to the concrete understanding of simple engineering processes. Any technical report excludes the use of adjectives or verbs, and engineering students must be instructed from the start how to communicate as professionals.

4. Little and conclusive information. Most courses seem more important based on their number of pages. In reality, however, this discourages students from learning. Thus, in the communication of information, a simplification of the courses might be more indicated, by eliminating the superfluous information or the one that is repeated. The time devoted to theoretical study must be shorter in order to give the possibility to apply this information practically, and this means an attempt to rethink online teaching towards a diminution and simplification of theoretical information and to think of possibilities for the students to work on more concrete, practical elements, at home, with the materials they can have at hand.

5. Active involvement and training. Online courses are a long series of monologues in which teachers become boring, tired and lose the students' attention. One of the recommendations is clearly to create the technical courses in a more lively, more active manner. The methods that can be used are complex, from short questions, to certain interventions on the part of the students, to related examples from the teacher's real activity or to videos to help in the teaching process.

6. Activation of the social component. Good technical communication should take into account the social component, in other words, it must be explained how the conveyed information, often too technical or impossible to interpret, has certain effects in society, because science and technology have immediate effects in everyday life, and concrete examples of the use of this information are essential. From the way of teaching students must understand that their work is for the benefit of the society, in order to make it easier and to improve its quality.

3.Purpose and assumptions

Based on these theoretical characteristics, the paper aims to answer some hypotheses:

Hypothesis 1. There is clarity in the communication of information in online courses.

Hypothesis 2. The content of the subjects is adapted to the students' level of knowledge according to the year of study.

Hypothesis 3. The conveyed technical information is conclusive and simplified.

Hypothesis 4. The students are actively involved in online activities.

Hypothesis 5. The technical information is doubled by the real examples of its use in society.

Hypothesis 6. Sufficient elements specific to online teaching are used.

The current study is a continuation of the authors' previous researches in the field and aims to identify the weaknesses of the online educational system in the higher technical field, in order to find solutions for these constraints.[1],[2],[4].

The study was conducted on a group of 320 students of the Faculty of Engineering and Information

Technology within the "George Emil Palade" University of Medicine, Pharmacy, Science and Technology of Târgu Mureș, 10 representatives of each specialization from each year of study.

The study period was in January 2021, after 9 months of learning exclusively online.

4.Outcome

As shown in figure 1, engineering students assessed the way the information was transmitted logically and clearly in a positive way. Out of the total number of 320 study participants, a considerable percentage appreciated the fact that the information was simple and clear, although the communication barriers in the online environment unquestionably existed. This fact highlights the fact that hypothesis 1, "There is clarity in the transmission of information in online courses" is confirmed.

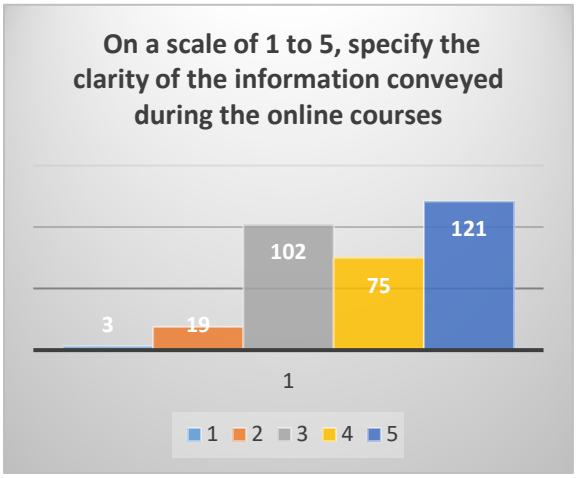

Figure 1. The clarity of the information during the online courses

Hypothesis 2, "The content of the subjects is adapted to the students' level of knowledge according to the year of study." is also confirmed, a fact that is illustrated in Figure 1, which leads us to believe that teachers have understood that technical learning in the online environment is more difficult and they have tried to adapt the content of the subject to the audience, in order to facilitate the understanding of the conveyed information.

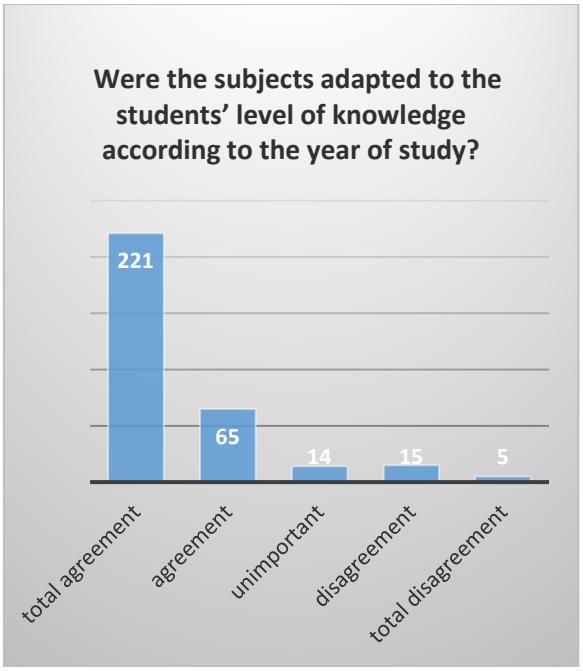

Figure 2. The subjects adapted to the students' level of knowledge according to the year of study

Figure 3 points out that in the technical reports or projects developed by students there was no superfluous information, which makes the way students are prepared for the technical world to be appropriate. It can be seen, therefore, that a sufficiently large percentage of the surveyed students considered that their papers were concise and adapted to the requirements.

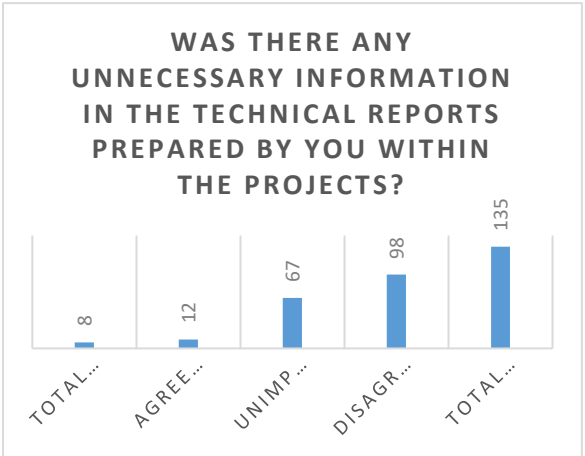

Figure 3. The way in which the subjects were simplified

Regarding the amount of technical information transmitted to students in online learning, it was quite adequate as far as the volume is concerned. The graph in figure 4 supports this statement due to the fact that the distribution of answers follows the Gaussian curve to a certain extent, and this is satisfying for the results of this study, which determines a maintenance of the percentage of information.

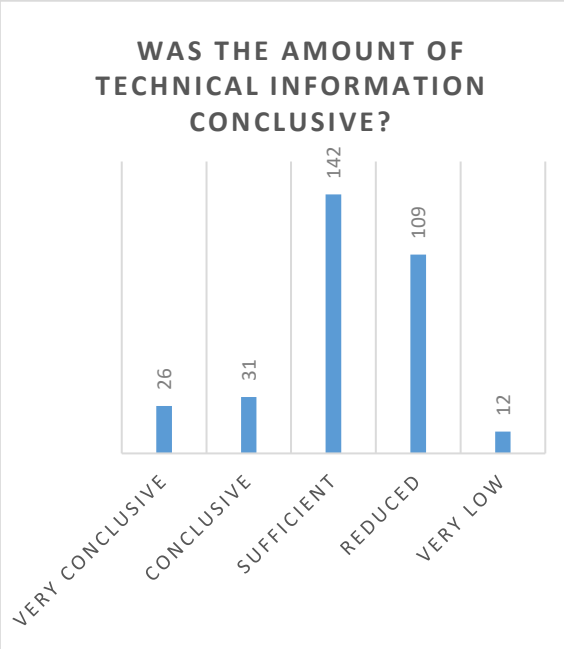

Figure 4. The quantitative volume of technical subjects

However, the graph in figure 5 raises questions about the quantitative volume of the subjects that were taught. Even if the technical subjects were considered appropriate in terms of volume, it seems students believe that the amount of information is too large. We consider that students are discouraged by too much information revealed in courses and seminars, perhaps due to insufficient time to read and comprehend everything. Thus, in the communication of information, a simplification of the courses might be more appropriate, perhaps by eliminating the information that is repeated.

Given the previous conclusions, unfortunately, hypothesis 3. "The conveyed technical information is conclusive and simplified" is not decisive, because the conclusions regarding the volume of technical information seem sufficient, but the entire information seems to be too exaggerated from the students' viewpoint. This fact determines us to consider the hypothesis inconclusive and to submit it to a more detailed study, perhaps focussing on the year of study or on different specializations.

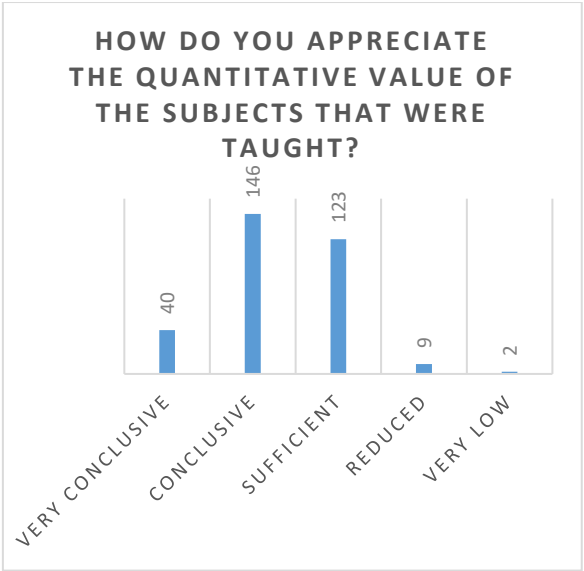

Figure 5. The quantitative value of the subjects

Regarding hypothesis 4. "The students are actively involved in online activities", it appears that we have an uncertain situation again. Online technical courses have the potential to become more animated, they can actively involve students in a more dynamic way of learning. However, figure 6. prevented us from drawing a clear conclusion, given the almost equal distribution of answers. This actually means that there is a possibility that from one specialization to another, or from one year of study to another, there may be obvious dissatisfaction or elements of good practice. We therefore intend to deepen this situation in the future research in order to have a much clearer conclusion.

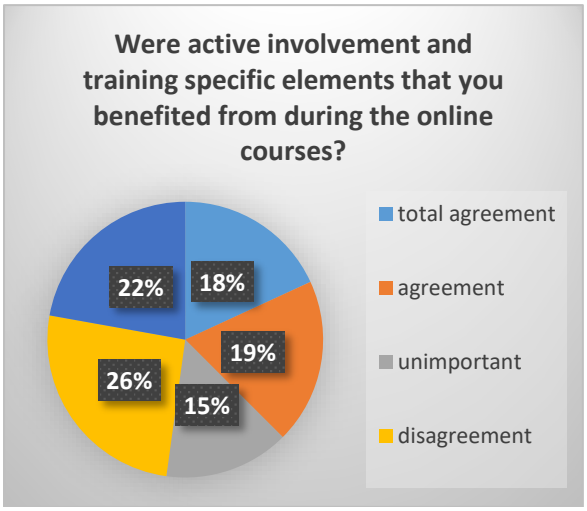

Figure 6. Active involvement and training of students in online courses

Figure 7 shows that a percentage of over 50% of the surveyed students are dissatisfied with elements related to the social component of the technical

information they have received. It is to be appreciated that the conveyed information is clear and conclusive, but our study shows that this particular information does not have the necessary component with the help of which the received data can influence our society nowadays, but especially in the future.

Every day we face elements that demonstrate that science and technology have strong effects in everyday life, and future engineers should know how their work can positively influence society, especially to improve the quality of life. Therefore, hypothesis 5. "The technical information is doubled by the real examples of its use in society" is denied.

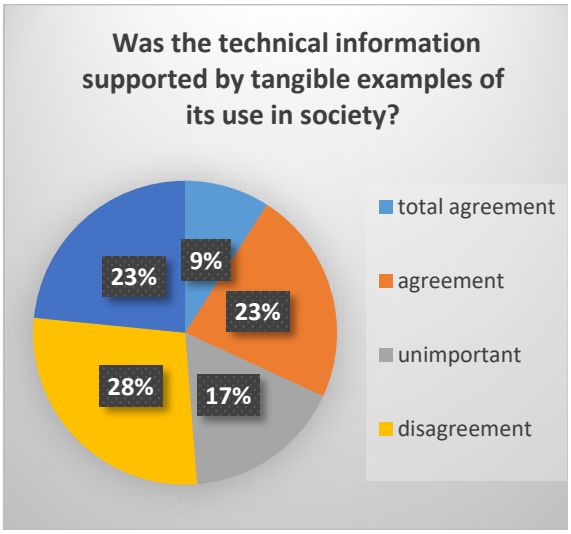

Figure 7. The benefits in society of the received technical information

Regarding the online tools used in the technical field for online teaching, the conclusions showed that images, tables and graphs were mostly used, elements specific to the technical field. Figure 7 shows that unfortunately, a smaller percentage had tools such as simulations and videos, elements that we consider to be useful and extremely modern in online teaching. We think this fact is due to the inadequate preparation of teachers in the use of specific software, or on too short a period of time in preparing for online courses. However, hypothesis 6. "Sufficient elements specific to online teaching are used" is confirmed, although there is still room for improvement.

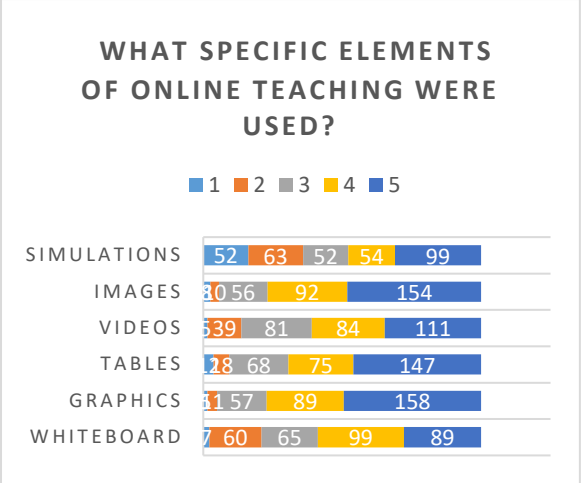

Figure 8. Specific elements of online learning in the technical field.

5.Conclusions

Consequently, the study offers a series of rules specific to technical communication and explains the way they were used by the teachers of the Faculty of Engineering. These rules aimed for the clarity of the conveyed information, the orientation towards students, the elimination of superfluous information from the content of the subjects, the active involvement and training of students during the courses, but also for the activation of the social component involved in the content.

Hypothesis 1. "There is clarity in the communication of information in online courses" is confirmed.

Hypothesis 2. "The content of the subjects is adapted to the students' level of knowledge according to the year of study" is confirmed.

Hypothesis 3. "The conveyed technical information is conclusive and simplified" is inconclusive.

Hypothesis 4. "The students are actively involved in online activities" is inconclusive.

Hypothesis 5. "The technical information is doubled by the real examples of its use in society" is denied.

Hypothesis 6. "Sufficient elements specific to online teaching are used" is confirmed.

Following the analysis of the above hypotheses, one of the most obvious problems is related to the fact that technical information does not have enough concrete examples of its use in society, which is particularly important for the future of engineers who should understand where exactly their work is useful in society both now and especially in the future.Hypothesis 1. "There is clarity in the communication of information in online courses" is confirmed.

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