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STUDIES ON THE REDESIGN OF THE TEACHING PROCESS USING THE METHODS OF QUALITY ENGINEERING

Abstract: *Experience as a university teacher has shown us that with the changing times, the student's attitude towards the teaching process changes.*
In this paper, the authors make an original study by aiming to lay the groundwork for a method of teaching courses adapted to the new requirements and new student capabilities.
The paper proposes a methodology to redesign the learning process, using the tools, techniques and methods specific to Quality Engineering, such as: QFD technique, AFFINITY diagram, ISHIKAWA technique, etc. Our aim is to increase the quality of the teaching process and, above all, to increase the student's interest towards the class.

Key words:*Quality Engineering, Design, teaching solutions, QFD, Quality tools.*

INTRODUCTION

Experience as a universityteachers has shown us that with the changing times, the student's attitude towards the teaching process changes.

Our observations and studies have shown that the student's ability to focus on an optimal level over a two hour period has dramatically decreased.

We also noticed that the student in the classroom, prefer not to take handwritten notes, prefer not to hand sketch drawings made at the blackboard by the teacher when necessary.

Studies on the subject covered by this paper have also shown that sketches and drawings made in the student notebook during the class are misleading and inadvertent, and this is worrying by its consequences.

Our studies also showed that the student expects the teacher to offer the entire lesson taught electronically, possibly online. The same is expected for the sketches / drawings of the respective course.

In order to meet the current needs of our students, the authors of this paper have launched a research program focused on the redesign of the teaching process that is perfectly oriented on the wishes expressed (or observed) by our students.

In this process, to collect more accurate data on student needs, we designed and given to students from the University Politehnica of Bucharest a questionnaire. This questionnaire contained several questions grouped into four major categories: management (organization), methods, teacher and enviroment.

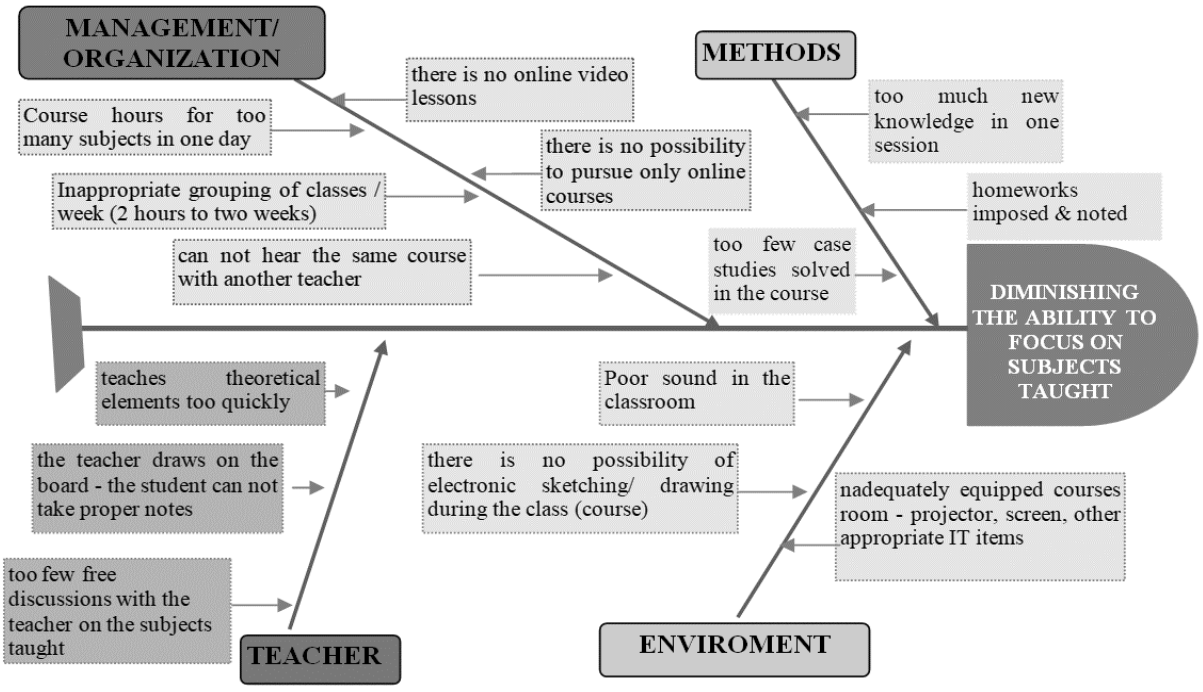


Fig.1 Ishikawa diagram built on the wishes of the interviewed students.

The subjects discussed and on which it has designed the survey are:

- current teaching methods,
- working environment in the classroom,
- the organization of teaching time allocated
- about who teaches the course.

The answers to the questionnaire led us in our approach to finding solutions perfectly suited to the students' expressed needs.

Starting from this point, in the present paper the authors have successfully used the quality tools to structure the information gathered first and then to find the best solutions for our students.

2. CASE STUDY by applying Quality Tools

2.1 Structuring information using the ISHIKAWA diagram and AFFINITY diagram

This paper aims to study the phenomenon that leads to the diminution of students' ability to remain focused on the subject being taught, in other words, the phenomenon of loss of concentration by the student.

We aimed to study this phenomenon using the tools provided by Quality Engineering.

First, to structure the information received from our students through questionnaire which we discussed above, we intend to use the Ishikawa diagram - presented in Figure 1.

As you can see in figure 1, with Ishikawa Diagram we managed to structure the four major classes, the causes that led to the effect that we have proposed to study.

As you can see in the diagram, students claim, among other things, that too much new knowledge is being taught in a single class session and that course sessions are at long-distance (one two hours course at two weeks).

Also, studies have shown that students wants to have the possibilities to hear the same course with another teacher, again, if they want to deepen the subject.

Students expressed their desire to have an up-to-date environment at the level of 2019 as regards course classes and laboratory or seminar.

Students also want more case studies explained and resolved with the teacher and first of all reveals their desire to have all the information in the online environment.

Based on this structured information, in order to better clarify the problem and to find the best solutions, the authors of this paper have used another tool provided by Quality Engineering, namely an Affinity Diagram with the precise purpose of refining the collected information (figure 2).

Using the Affinity Diagram shown in figure 2, we created three distinct categories of causes that lead to the problem being asked: capability to focus down (in time); poor insight into the importance of the subject; since childhood habit with IT tools.

Corroborating the two charts above, it has come to the conclusion that the current generation of students, given that they were born and grew up in the massive and explosive era of IT development, prefers the lesson to be computerized (no paper).

Students also want to have the appropriate IT tools such as tablets, electronic pencils, etc.

The fact that the current generation is accustomed to the rapid change of information, specific to the online environment, wants the same thing in the classroom. This leads to loss of attention on the subjects taught, if they do not change rapidly and if they are not immediately preceded by concrete case studies or immediate demonstration of their usefulness.

Habitual since the early childhood of watching video demos in the online environment also leads to the request of this generation of students to have on-line video courses.

2.2 Finding solutions using Quality Engineering tools

Following the use of dedicated Quality tools by their definition in structuring and clarifying the issues (figure 1 and figure 2), a number of problems have clearly emerged, waiting for solutions from us, professors and not only.

To respond as accurately and as systematically as possible to the expressed wishes of our last-generation students (2018-2019), and to be capable to redesign the whole process of teaching congruent with current trends, in our approach we used a tool named “Tree Diagram”, presented in figure 3, which allows step-by-step to approach the solutions to problems discovered on the proposed theme.

Figure 3 shows how the solution was applied perfectly on the categories of problems highlighted by the other two Quality tools used in this paper.

The Quality tool named “Tree Diagram” is a “*graphic tool which systematically breaks down, and then maps out in increasing detail, all components or elements of a condition, phenomenon, process, or situation, at successive levels or stages*”[5].

The Tree diagram designed by the authors deals with the problems highlighted by the Ishikawa and Affinity diagrams presented in the previous chapter. As can be seen in figure 3, the Tree diagram allows the development of solutions as well as decision-making on the competent solution of the problems encountered.

As we can see, a solution found would be the introduction of some ten-minutes sessions requiring students to apply freshly taught information on a case study. Thus, we can keep alive and awake student attention throughout the session.

Other solutions found in the research study covers need online. Thus, the authors propose a constructive discussion with the university management for an adequate IT systems compatible with the needs of students.

Another proposed solution would be to remove the homework from the obligatory area and to add additional marks to the students to solve the homework.

For a concrete and concise solution, the QFD technique provide by the Quality Engineering tools [2], [3], [4], was used to build a House of Quality, as shown in figure 4.

House of Quality ([3], [4]) is a very useful tool that provide a clear action plan to extinguish the needs of our students.

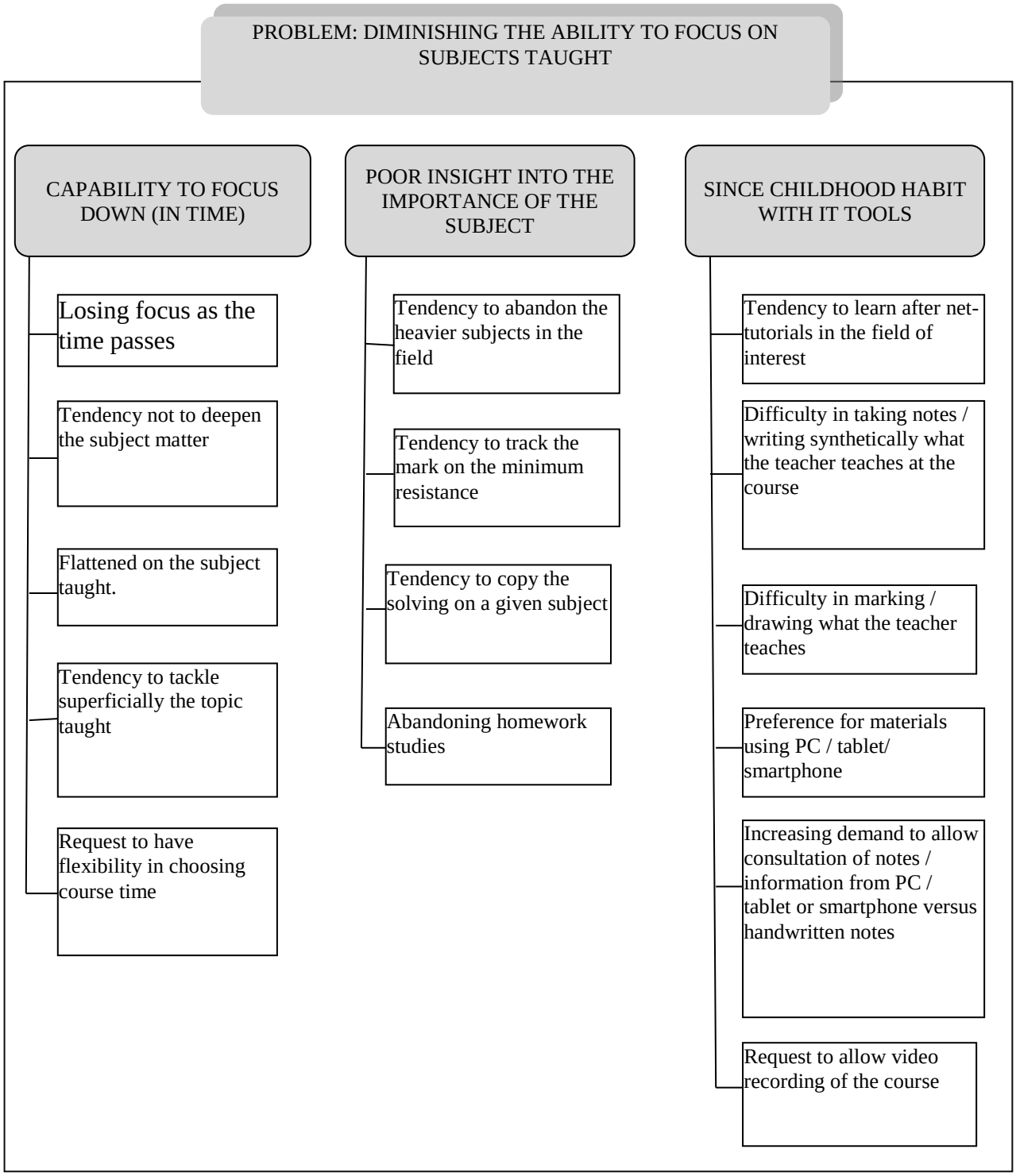


Fig. 2 Apply the Affinity diagram to structure the collected information.

It should be noted that in order to receive feedbak quickly from our students, we adapted the form used in the paper [1], and more, we have left questionnaires to be filled in also at the Polytechnic Library of Bucharest.

Seven solutions have been proposed, which, as can be seen in Figure 4, respond very well to the most important demands of the 2018-2019 generation of students of the Polytechnic University of Bucharest.

CONCLUSIONS

The purpose of this paper was to increase the quality of the teaching process and, above all, to increase the student's interest towards the class.

In the QFD diagram of figure 4, it can be noticed that the solutions found in this research cover very well the needs expressed by the students of our university.

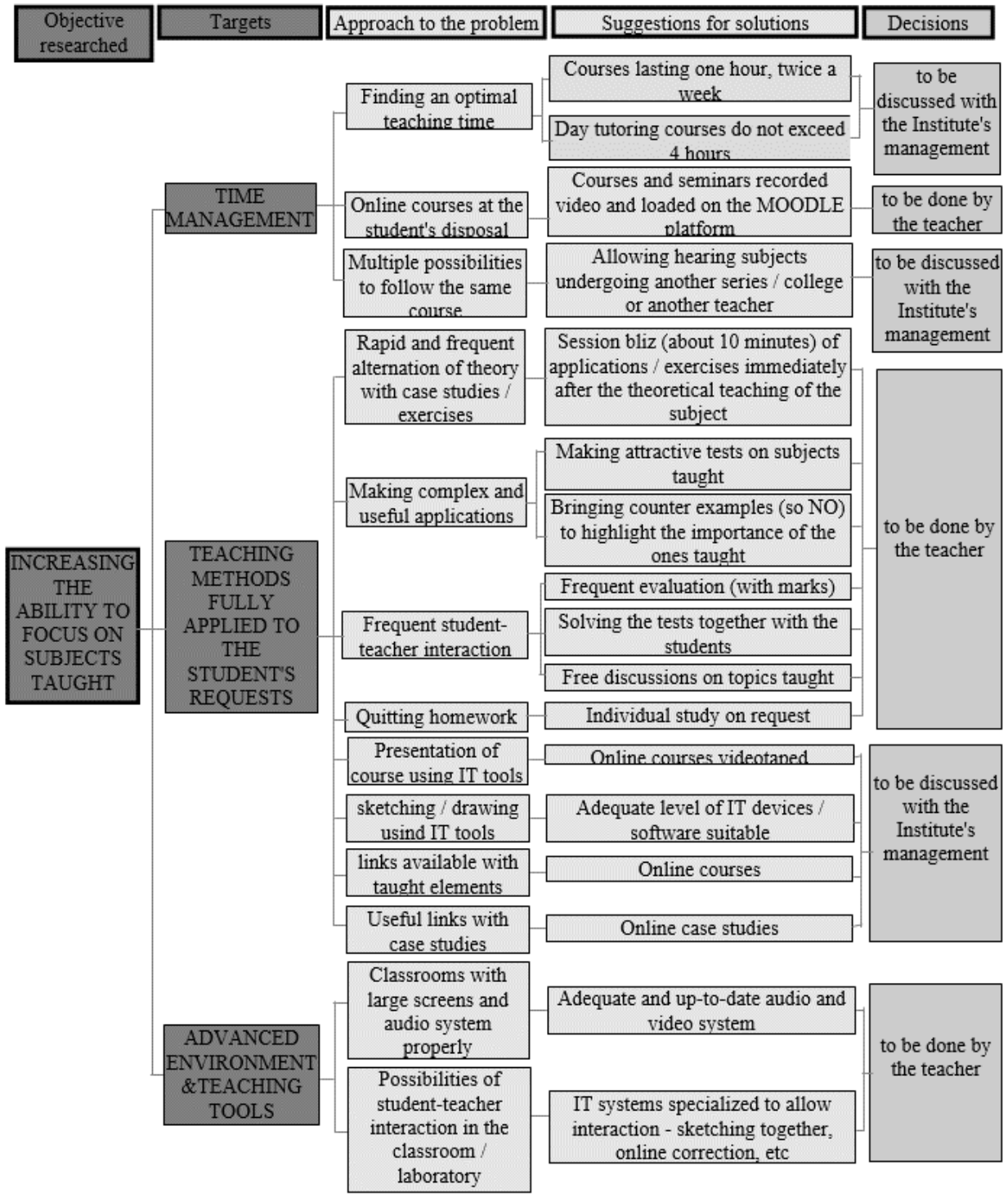


Fig.3 The TREE diagram built to find ways to solve the problems highlighted.

To see more clearly that, based on House of Quality from figure 4 we have built a bar chart (figure 5) which clearly reflects which solution is more effective to answer to the expressed needs.

As seen in figure 5, the solution 3 "*Online courses and case studies*" respond positively to all seven needs expressed and selected by us to be extinguished.

Solutions 5 and 6 also responds successfully to the wishes of today's generation students.

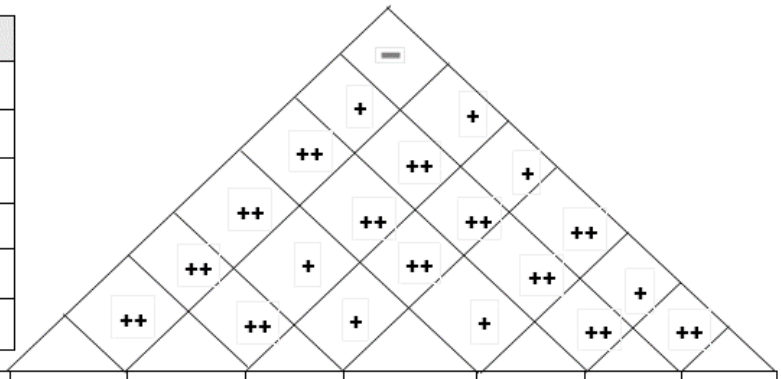
Analyzing the top matrix of the QFD scheme in figure 4, referred in the specialized literature as the "*roof of the House of Quality*", we can make the following observations based on the links established between the seven solutions found:

• Solution 1, which proposes to reduce the practical working day, is in perfect harmony with all the other solutions, except solution 7, which demands more time for the taught matter;

• Solution 2 allows flexibility for a given subject. Thus the student spends his / her time allocated to hearing a particular course, in a flexible and convenient way;
• Solution 3 is perfectly compatible with all other solutions found and responds well to the needs expressed;
• Solution 4 is intended to stimulate students' desire to have a high score and this can indirectly lead to the accumulation of additional knowledge on a given subject;
• Solution 5 depends exclusively on the reputable university management's competence and should be something usual in this century of explosive development of the IT industry;
• Solution 6, which is meant to effectively attract the attention of the student, depends on the degree of involvement of the course teacher and the degree of involvement of the whole team;
• Solution 7 is intended to keep the student's attention to the subject being taught. Interestingly, our students have expressly requested this solution following discussions with the authors of this paper.

In this paper we applied the Ishikawa diagram and the Affinity diagram to structure the information gathered from the students as clearly as possible.
Then we structured the information gathered using an Tree diagram, which also allowed us to find perfectly matched solutions to the student's expressed demands.
At the end of this paper we built a House of Quality based on QFD methodology, which has helped us to see clearly what are the priority solutions to quench the needs expressed especially, this tool has helped us to see

Symbol	Meaning
★★	Strong relation
★	Moderate relation
−	Bad correlation
	Not obvious correlation
++	Strong affinity
+	Moderate affinity



		1 ↓	2 ↑	3 ↑	4 ↑	5 ↑	6 ↑	7 ↑
	To do! „HOWS" / Requirements „WHATS"	Day tutoring courses do not exceed 4 hours	Allowing hearing subjects undergoing another series / college or another teacher	Online courses and case studies	Providing additional credit points for an additional individual study	Adequate level of IT devices / software suitable	Making attractive tests on subjects taught	Frequent evaluation (with marks)
1	Time teaching to be shorter	★★	★	★★		★		
2	Courses can also be heard at another teacher	★★	★★	★★	★	★	★★	★
3	Courses and solved case studies to be available online	★★	★★	★★	★	★★	★★	★
4	Homework is not imposed mandatory			★	★★	★	★★	★★
5	More practical applications		★★	★★	★★	★★	★★	★★
6	Rooms suitable for modern hearing courses	★	★	★★		★★	★★	★
7	Make courses particularly attractive	★	★★	★★	★★	★★	★★	★★
CONCLUSIONS :		**Must pay attention to the divergence of solution 1 and 7**						

Fig. 4 House of Quality for finding solutions specifically targeted at students' requirements.

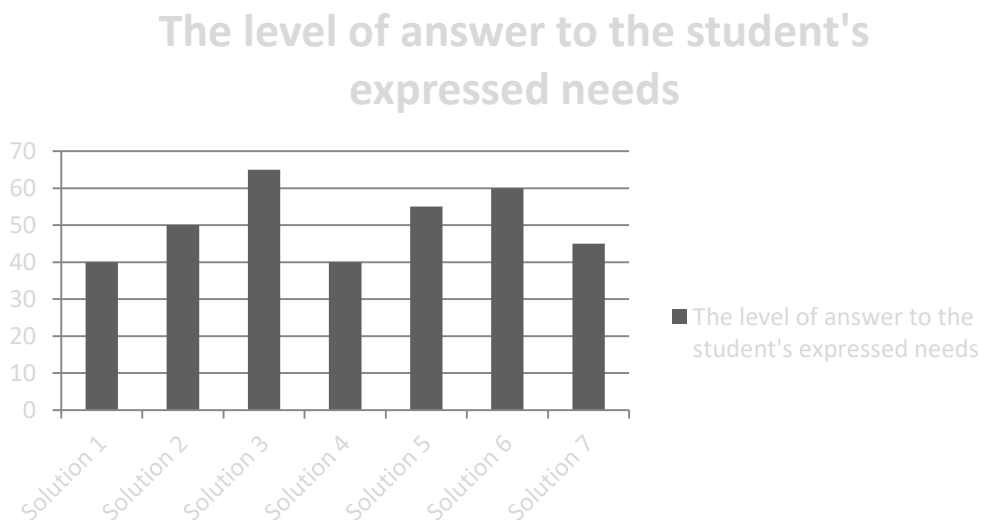


Fig. 5 The level of answer to the student's expressed needs.

the compatibility of the solutions found.

House of Quality through the top matrix has revealed that some solutions can influence each other negatively. This has to be carefully considered and taken accordingly.

In conclusion, we believe that the application of the tools provided by Quality Engineering offers a clear picture of the situations to be solved and helps to find the best solutions.

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