COMPARATIVE ANALYSIS OF THE IMPORTANCE OF THE METHODOLOGICAL QUALITY ASSURANCE CRITERIA OF TWO STUDY PROGRAMS USING OPTIMIZATION MODEL

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Abstract: Over the past three decades, quality assurance mechanisms and processes in higher education have become one of the most common aspects of the educational systems in Europe, USA, Canada and Australia. There were multiple reasons and factors that have contributed to this development, all of them converging into the following common statement: The overall development of each country based on the increased productivity and being competitive in the modern economy is directly related to having workforce that is appropriately educated, possessing the necessary skills and competencies to engage in the social, economic and industrial life of the country. This normally led to increase of the public funding of the educational system, especially public educational institutions that are the universities themselves. This meant not only increasement of the budget for the public universities, but also establishment of new study programs that will produce educated people ready to respond to the modern trends and also making the higher education more affordable and accessible to different categories of population. Need for establishment of mechanisms for quality assurance in higher education emerged naturally in the world, where having a strong relationship between the needs of the labor market and the structure of the study programs at the faculties is a must. Multiple approaches are developed in this context, bearing in mind the difference of the importance of all the features and characteristics of the study programs in different countries. One of the important aspects of the study program as core unit at each faculty is the methodological (pedagogical) aspect of the process of knowledge delivery teacher → student. Multiple criteria define a set that can be used to describe and measure the efficiency of this relation. Mathematical modeling technique AHP (Analytical Hierarchy Process) is applied to two completely different study programs (Turkish language and literacy and Computer engineering and technologies), measuring the importance of preselected methodological criteria and processing the data through the AHP mechanism. The preselected criteria are: planning and organization of the teaching process towards student's needs, realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice, use of new educational methods and technologies in the teaching process and mentoring the students. The final result is comparation of the importance scales of the criteria related to the non-technical and technical study program from the first cycle of studies, which gives information about the quality level of each criterion related to each study program, thus giving information about the needed level of improvement of some criteria.
Keywords: higher education, quality assurance, analytical hierarchy process, mathematical optimization

1. INTRODUCTION

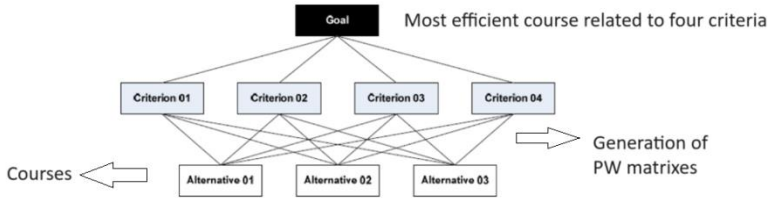
Quality assurance processes and mechanisms can be perceived differently in different institutions, systems and different perspectives of importance. In terms of higher education institutions, it is related directly to the processes of evaluation and self-evaluation activities, conducted regularly at the universities to measure the key performance indicators. Different aspects are evaluated regarding the study programs, teaching processes, students, conditions, technical methods, usage of ICT etc. Most of the (self) evaluation challenges are directly related to the study programs as core unit of the universities. The intention is to construct study programs that will be designed to meet the individual learning needs, but also prepare the person for higher learning, training and/or employment. Within the conduction of the courses, students should gain and develop the knowledge, skills and behaviors needed for the future. One important question is how those knowledge, skills and behaviors are transferred from the teachers to the students, that is, how the performance of the teachers and the teaching processes can be evaluated, what surveys are to be conducted and how those data will be interpreted in order to measure efficiency. Approach using mathematical optimization technique AHP (Analytical Hierarchy Process) is used for processing the data, based on parameters picked as important ones to describe the methodological aspect of study program, that is how professors perform during the teaching process. Four parameters are chosen due to surveys done at the Goce Delcev University in Stip, Republic of North Macedonia, related to two completely different study programs: Turkish language and literacy and Computer engineering and technologies. The results allow us to make the comparison among the efficient and relatively not so efficient parameters / performances of the teachers and suggest optimization steps.

2. MATERIALS AND METHODS

AHP (Analytical Hierarchy Process) is an optimization technique that can be used for organization and analysis of complex decision using math and psychology. In order to solve the goal, we define possible alternatives of the solution and all the criteria that the judgements from the observers are made on. With transition from qualification to quantification, mathematical operations are possible towards generation of the final result. In this research, AHP is applied until comparison matrixes are constructed and index of consistency is calculated. Later, these results can be used for calculation of the most efficient course in the study program, related to the criteria defined, as shown in Figure 1. Two study programs from the first cycle of studies at the Goce Delcev University in Stip were analyzed:

- Turkish language and literacy, Faculty of philology, with 79 students participating at the survey, from generations 2013/2014 – 2017/2018, and
- Computer engineering and technology, Faculty of computer science, with 54 students participating at the survey, from generation 2017/2018.

Figure 1. AHP model



All of the students had finished their studies, so the judgements about the importance of the criteria were relevant since the complete experience they had for all the courses and professors at the study program.
Four criteria are chosen for analysis of the methodological aspect of both the study programs:

- Planning and organization of the teaching process towards student's needs (Criterion 1 in AHP),
- Realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice or more practical work during the studies (Criterion 2 in AHP),
- Use of new educational methods, tools such as software/hardware and/or others, approaches, and technologies in the teaching process (Criterion 3 in AHP), and
- Mentoring the students, meaning of the possibility for individual work of the teacher with each student, thus bigger support and guidance (Criterion 4 in AHP).

Among multiple questionaries conducted, towards the goal of this paper, only the questionnaire necessary for the construction of the comparison matrices (PW matrices) was taken into consideration, which is gathering the judgements of the students about the mutual importance relationship of the four criteria, using the 9-level Saaty's preference table, shown on Table 1. Via AHP, comparisons that are used empirically are transformed into numerical values that can be processed with further actions.

Table 1: Saaty's preference table

Scale	Compare factor between element i and element j of A
1	Equally important
3	Weakly important
5	Strongly important
7	Very strongly important
9	Extremely important
2,4,6,8	Intermediate values

3. RESULTS

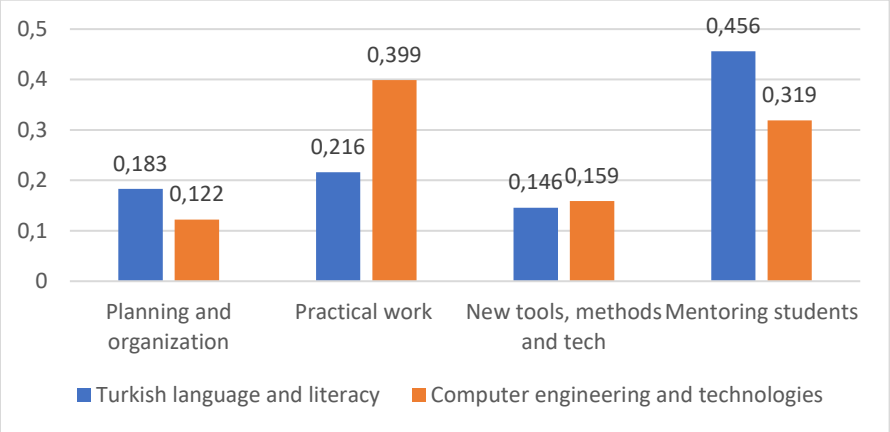
PW matrices, showing the resulting judgements are shown in Table 2, for both the study programs:

Table 2: PW values for the methodological criteria for both study programs

Criterion	PW – Turkish language and literacy	PW – Computer engineering and technologies	Criterion
Planning and organization of the teaching process towards student's needs	0,83	0,26	Realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice or more practical work during the studies
Planning and organization of the teaching process towards student's needs	1,38	0,9	Use of new educational methods, tools such as software/hardware and/or others, approaches, and technologies in the teaching process
Planning and organization of the teaching process towards student's needs	0,37	0,37	Mentoring the students, meaning of the possibility for individual work of the teacher with each student, thus bigger support and guidance
Realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice or more practical work during the studies	1,33	1,99	Use of new educational methods, tools such as software/hardware and/or others, approaches, and technologies in the teaching process
Realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice or more practical work during the studies	0,5	1,34	Mentoring the students, meaning of the possibility for individual work of the teacher with each student, thus bigger support and guidance
Use of new educational methods, tools such as software/hardware and/or others, approaches, and technologies in the teaching process	0,32	0,46	Mentoring the students, meaning of the possibility for individual work of the teacher with each student, thus bigger support and guidance

Further processing of the results in table 2 via AHP, related to both the study programs lead to the priority vectors with the criteria weights for both the study programs, shown on Figure 2:

Figure 2. Priority vectors



The index of inconsistency, showing the level of reality of the judgements is calculated, regarding both the study programs:
- CI (Turkish language and literacy) = 0,27%, and
- CI (Computer engineering and technologies) = 1,026%,

meaning that the consistency is pretty solid (inconsistency must be under 10% according to Saaty, measuring the imperfection of the people's judgements which is a factual reality), allowing us to conclude that judgments of the students were real and the parameters / criteria were comparable.

4. DISCUSSIONS

From the results shown at Figure 2, several important points can be seen:

- For both the study programs, the students' judgements showed that the most important criterion in this research is Mentoring the students, meaning of the possibility for individual work of the teacher with each student, thus bigger support and guidance. It is even with higher score in the Turkish language and literacy, which can be connected with the lower number of students in general and the reality where the percentage of mentorships and individual work and classes are greater than the other study program. Another assumption is that this had led to very good success of the students.
- For both the study programs, maybe not so important criterion is Planning and organization of the teaching process towards student's needs. This also is related to the pretty great weight of the Criterion four, that is no need for special organization of the teaching class when individual work is available enough.
- For the criterion Realization of the teaching process through bigger encouragement of the students to apply the knowledge in practice or more practical work during the studies, the criterion weight is almost double for the study program Computer engineering and technologies. This clearly shows that the engineering study programs are strongly corelated with the need of greater inclusion of practical work during the studying, thus producing better educated staff ready to be involved in the economy/industry.
- Related to the Use of new educational methods, tools such as software/hardware and/or others, approaches, and technologies in the teaching process, it is shown that the importance is relative / not so great. This can be interpreted as the fact that the teaching process involves enough and solid methods and approaches, thus something new is not necessary at the moment.

5. CONCLUSIONS

This model evaluates the methodological aspect of the study program, that is How the process/teaching is done / How the knowledge is transferred. The criteria are selected from a greater set defined in the document Qualification standard for teachers in higher education, with intention to reform the complete procedure of evaluation in higher education, evaluation of professors and study programs etc. This means not only generating reports with numbers, but also implementation of mechanisms to process those numbers and generate the results, about the reality and suggest measures for improvement.

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