An Approach to the Quality Rating of the Bachelor and Master's Curricula

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Abstract - **This paper presents an approach to the quality rating of the Bachelor and Master's curricula. It is based on the estimation and analysis of the courses eligibility level and can be used to compare different curricula. A suitable curriculum model is offered too.**

Keywords - **Bachelor, Master, curriculum, eligibility, quality.**

I. INTRODUCTION

As it is known, the main purpose of the educational system lays in the preparation of qualified and skilled persons, required by the society, with a realization of full value. Nowadays, in relation to the sweeping changes in business and politics, new necessary qualities become topical in order to get a high-paid job and for a successful professional career [1]. This requires considerable changes in the educational content, first of all, in the used educational technologies. It strongly affects the higher education field, which has to adapt itself fast to high technologies and the changing market and labour conditions.

According to the new Regulations for State Requirements for receiving a university degree in Bulgaria, training in each speciality (major) must be carried out under certain curriculum [2], which includes compulsory, elective and optional courses. The compulsory academic courses must provide fundamental training in the chosen professional field, the elective ones - necessary specific knowledge and competencies in the chosen subject field.

The eligibility of courses is one of the most significant indicators of the curricula quality and it becomes the main prerequisite for providing internal and international students' mobility and specifying their preparation in the desired direction. These goals are completely in unison with the UNESCO recommendations [3,4] for higher education improvement and quality increasing.

Having in mind the above-mentioned facts, this paper treats a developed approach to quantitative estimation of the Bachelor and Master's curricula quality. It is based on the analysis and evaluation of the level of course eligibility, comprised in these curricula. At the same time, the paper offers a model for design and presentation of such curricula, which is completely suitable for usage. Its accepting will provide the unification, larger transparency and clearness as well as more efficient control on the quality of the process of academic studying.

II. A MODEL FOR CURRICULA PRESENTATION

It is advisable to mark each course with a *code for the particular curriculum* (*curriculum code*) and a *common code* (*department code*) used in all academic curricula at university, where it is included. It is suitable for the *course code for the particular curriculum* to contain short names of the academic degrees (for instance: B - for Bachelor, M - for Master) and the major, also the number course position in this curriculum. The common code should contain the short name of the department, providing this course, and the number of the course within the frames of the corresponding department. Opposite the pointed out codes, it is logical to write "elective course from:" or a particular title, if the course is not elective. For example,

…..		
B_CST_25	CSE_18	Computer Nets
….		
B_CST_33	E	An elective course from:
	MAT_09	Operations Research
	TEM_12	Numerical Methods
….		
B_CST_44	E	An elective course from group A
B_CST_45	E	An elective course from group B
B_CST_46	E	An elective course from group C
….		

<div align="center">Courses from group A</div>

CSE_36	Cryptography and Data Protection
CSE_42	Internet Technologies
COM_31	Optical Communications
ELC_28	Measurements in Electronics

<div align="center">Courses from group B</div>

CSE_38	Net-based Programming

The first line in the example with B_CST_25 is the code for *Computer Networks* course in the particular curriculum and it means, that the curriculum is for Bachelors' training, the major is CST (Computer Systems and Technologies) and the

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course position in this curricula is 25. In this case the common code CSE_18 shows that the department, providing a certain course, is CSE (Computer Science and Engineering) and its code within the department frames is 18.

The course B_CST_33 is elective (E) from the courses *Operations Research* and *Numerical Methods.* The Department of Mathematics (MAT) provides the first course, The Department of Theoretical Mechanics (TEM) - the second one. The adopted codes of these courses within the frames of the departments are respectively 09 and 12.

B_CST_44 is a curriculum code in the discussed example for an elective course from group A, which includes 4 courses, provided by different departments and so on.

It is obvious that, in order to implement the above-described model in a particular university for curricula design, it will become necessary to acquire common short names of majors and departments in the corresponding native language and in English, and also codes for all courses, provided and offered by different departments. It is quite clear that in dependence on the desired detail of the curricula design, each line in the above-discussed example can be complemented with usual necessities such as final procedure, number of classes, type of classes, week loading and ECST (European Credit Transfer System) credits.

III. ESTIMATION OF THE ELIGIBILITY LEVEL IN THE CURRICULA

In order to estimate the level of eligibility in the curricula, the introduction of *coefficient of eligibility* is offered. It can be determined for each individual course, separate semester, groups and the whole curriculum,

The *coefficient of eligibility* for each course C_e can be estimated simply by number n of the offered courses, one of which the student has to chose as compulsory.

Thus, if a certain course is not elective in l-position of the curriculum, but compulsory, it will be denoted with its title and its coefficient of eligibility C_e will be equal to 1, since $n=1$ in this case. If, for example, the following is written in position l:

l) An elective course from

<course 1>
<course 2>
<course 3>,

the coefficient of eligibility C_e in this case will be $C_e = n = 3$. On analogy, in the above-mentioned example, the coefficient of eligibility of the B_CST_33 course is equal to 2, the B_CST_44 - to 4.

Therefore, the coefficient of eligibility for each semester C_s can be defined from the following expression:

$$C_s = \frac{m}{M} + \frac{\sum_{j=1}^{M} C_e^{(j)}}{M} \qquad (1)$$

where

$C_e^{(j)}$ - coefficient of eligibility of j-course in certain semester;

j - index of courses in a semester;

M - total number of courses in a semester;

m - number of the elective courses in a semester

Then the coefficient of eligibility of the whole curriculum (programme) can be defined on analogy with the expression

$$C_c = \frac{q}{Q} + \frac{\sum_{h=1}^{Q} C_s^{(h)}}{Q} \qquad (2)$$

where

Q - number of semesters in the curriculum;

$C_s^{(h)}$ - coefficient of eligibility per semester h;

h - index of semesters in the curriculum;

q - number of semesters with elective courses.

As it has already been mentioned, the introduced coefficient of eligibility equals 1 for all compulsory courses from the curriculum. If elective courses are not offered, i.e. all courses are only compulsory ones, then $m=0$ and the coefficient of eligibility C_s for that particular semester will also equal 1. On analogy, if there are no semesters with elective courses, then $q=0$ and the coefficient of eligibility of the whole curricula C_c will also receive a value of 1, following the offered formula (2).

When a particular semester from the curriculum has several or all elective courses to be chosen from a common group of offered courses, then the coefficient C_e for each course is advisable to be calculated as:

$$C_e = \frac{G}{g} + \frac{G-g}{G} \qquad (3)$$

where
g - number of the elective courses to be chosen from a corresponding common group of offered courses (obviously, $g \leq m$);

G - number of offered courses in the common group from which g courses have to be chosen

The second part $[(G-g)/G]$ in the proportion (3) logically allows increasing the eligibility estimation of individual courses in comparison to the alternative case, when each elective course is compared to one of its subgroups in the group of offered courses G.

For example, let $g=2$, $G=4$ and the corresponding writing in the curriculum for the discussed semester be the following:

l) An elective course from group H
l+l) An elective course from group H

Courses from group H

<course 1>
<course 2>
<course 3>
<course 4>

In the alternative case the writing in the curricula will appear in the following type:

l) An elective course from
<course 1>
<course 2>

l+l) An elective course from
<course 3>
<course 4>

According to formula (3), the coefficient of eligibility $C_e = [4/2+(4-2)/4]=2.5$ is received in the first case for each of both elective courses (in position *l* and *l+l*), while in the alternative situation the coefficient is $C_e = n = 2$.

The higher value of C_e is logically due to the greater variability of students' choice. It is evident that the number of variants in this case equals the number of combinations in the second level of all 4 elements, i.e. $C_4^2 = 6$, in the other case the variants for course choice are 4.

IV. An Example

The coefficients of eligibility will be defined as an example in the curricula of three Master's programmes (*Programming Systems and Technologies*, *Informatics*, *Computer Systems and Nets*) at the Department of Computer Science and Engineering (CSE) at the Technical University of Varna, Bulgaria. They are presented in [5]

The curricula of each of the above-mentioned Master's programmes contain two academic semesters and the third one is for diploma project and its defense. During each academic semester five courses have to be studied and they are selected from the corresponding groups, containing 10 offered courses. For instance, the curriculum of the first Master's programme at the CSE Department (*Programming Systems and Technologies*) includes the following courses:

1st semester
Five elective courses from
- Systems Analysis
- Numerical Methods
- Parallel Algorithms and Systems
- Parallel Programming
- Language Processors
- Web Design
- Designing Java Applications
- Programming with C# and Visual Studio.Net
- Neural Nets and Applications
- Manager Decisions

2nd semester
Five elective courses from

- Web Applications with C# and Visual Studio Net
- Distributed and Net Databases
- Net-based Programming
- Expert Systems
- Program Diagnostics
- WAP Information Technologies
- Distributed and Net Operating Systems
- Designing Object-oriented Applications
- Integrated Computer Systems and Nets
- Risk Analysis

3rd semester
Diploma project and its defense

In this case $g=5$, $G=10$ and the coefficients of eligibility of different courses during each individual semester of Master's programmes are received according to the formula (3) as $C_e = [10/5+(10-5)/10]=2.5$

The coefficient of eligibility for each semester is received following the formula (1), at $m=M=g=5$, when $C_s=3.5$. According to (2), $C_c = 4.5$ for each one of the three Master's programmes is defined for each semester at $q=Q=2$

The values of C_s and C_c show that the eligibility level in the discussed Master's programmes is of a very high level. What is more, it actually reaches the maximum, since it can be increased in this case only by ungrounded further increase of the G value.

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