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## EVALUATION OF STUDY PROGRAMME EXTERNAL QUALITY

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### Abstract

Quality assessment of a study programme is a topical issue in the single education area. Quality is not a unequivocal term in higher education area, which lends itself to many understandings and interpretations according to different criteria. The best practice of software engineering may be applied for the study programme evaluation if by analogy it is viewed as software product. Study programme similar to software product has internal and external quality. Students as direct users of the study programme may be engaged in the evaluation of its external quality, in case the evaluation of internal quality of the study programme is mainly based on internal resources of a higher education institution. The paper provides the methodology for evaluation of external quality of a study programme based on software product quality model and quality assurance standards. Approbation of the methodology was started in 2009 at the Faculty of Information Technologies, where students evaluated external quality of undergraduate study programmes. Results obtained during the approbation lead to the conclusion that the chosen methodology ensures significant information for the enhancement of quality of a study course and simultaneously the entire study programme.

**Key words:** study programme external quality, quality requirements, measurement, quality evaluation.

### Introduction

Quality enhancements of the study process and study programmes are issues that have always been more or less topical for higher education institutions. Currently this topicality is especially explicit when European countries collaborate on the establishment of a single Higher Education Area. In compliance with the decisions (Standards and Guidelines..., 2005) passed in the framework of the Bologna Process, the primary responsibility for the study process quality assurance in higher education lies with each institution itself. In the sphere of education, external assessment of the study programme relates to an audit performed by an external organisation and traditionally it is accreditation. Accreditation ensures the state guarantee for the study programme quality. However, internal quality assurance of a study programme includes measures regularly undertaken by higher education institutions themselves. Annual self-evaluation of study programmes is one of these measures. Self-evaluation is a vision of a higher education institution on the internal and external quality of the study programme. Consideration of the data included into self-evaluation reports of the study programmes leads to the conclusion that the valuation in compliance with the quality definition (Procedure for Accreditation..., 2006) is performed with regard to certain defined requirements. For example, Item "Evaluation of Study Programme" of the Cabinet Regulations "*Procedure for Accreditation of Higher Education Institutions, Colleges and Higher Education Study Programmes*" covers such information as "valuation system" (justification for the choice of valuation methods and analysis of results). Self-evaluation reports are also one of the sources of information used by external evaluation organisations. Hence, self-audits and self-evaluation reports prepared by an education institution are essential tools for enhancement of the study process. Criteria according to which a study programme is to be evaluated shall be defined

prior to the performance of self-audit or self-evaluation of a study programme. Self-evaluation report shall include the following information: development of the study programme, its practical implementation, valuation system of study results, information on students, qualification of the academic staff, sources of financing and provision of infrastructure, recommendations for the enhancement of work quality, and programme development plan (Procedure for Accreditation, 2006). Nevertheless, this information is detailed, mainly it is descriptive information, and it does not reflect a detailed quality evaluation of the study programme content. It is difficult to make inter-comparison of study programmes or qualitative evaluation of their content based only on the self-evaluation reports of these study programmes. Literature suggests possibilities for the evaluation of study programmes. A. Briška (Briška, 2008) proposes to determine quantitative indicators, for example, number of applicants, financing, resources, number of students, study environment, academic staff, internationalisation, and alumnae, for the evaluation of the study programme. The higher the quantitative indicators, the more qualitative is the programme. I. Gvaramadze (Gvaramadze, 2008) suggests reorienting the focus from quality assurance towards quality culture, thus displaying two significant emphases – quality transformation on the level of academic and administrative staff of the education institution and quality enhancement on the administrative level of the education institution. According to I. Gvaramadze, periodic quality assurance mechanisms are not enough to deliver and maintain the quality level of a study programme but they need a permanent updating, and developing of means and facilities for programme delivery, educational processes and educational outcomes. H. Coates (Coates, 2005) in his researches denotes the increasing importance of student engagement in the study programme quality assurance and

enhancement. Students' evaluation may display the most essential drawbacks in the quality of a study programme as well as positive trends of the study programme quality.

**Materials and Methods**

The author of the present paper would like to offer a method for the evaluation of external quality of the study programme based on the student engagement in the particular process. Quality evaluation methodology is based on the analogy with quality model of software product ISO

9126 and quality assurance standards. Internal and external quality of a study programme may be viewed similar to the quality of software products (Čevere and Sproģe, 2010). *External quality* – degree up to which programme satisfies a user's defined and imagined needs applying it on certain conditions. *Internal quality* – a set of programme attributes, which determines its ability to satisfy defined or indirectly specified needs, when applying it on certain conditions. Figure 1 reflects a schematic description of a study programme quality.

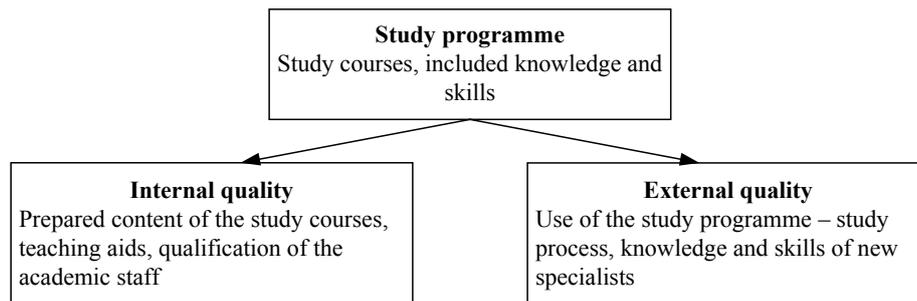


Figure 1. Classification of quality of a study programme.

Software product quality is determined by:

- ◆ internal quality – internal characteristics of software product;
- ◆ external quality – external characteristics of software product defined during its performance;
- ◆ quality in use – degree up to which a user may achieve its goal in a certain environment.

All software product characteristics originate during the development process. Quality of development process promotes assurance of product internal and external quality; while product quality structured by internal and

external quality, promotes the quality of application (use). Feedback for the evaluation of application quality shall be established to achieve the enhancement of quality to be able to improve the product; while feedback for the evaluation of the development process shall be established for the evaluation of the product.

The software product quality model ISO 9126 (ISO/IEC 9126-1, 2001) earmarks 6 internal and external quality characteristics and 27 sub-characteristics (Figure 2), which generally determine the quality of a product.

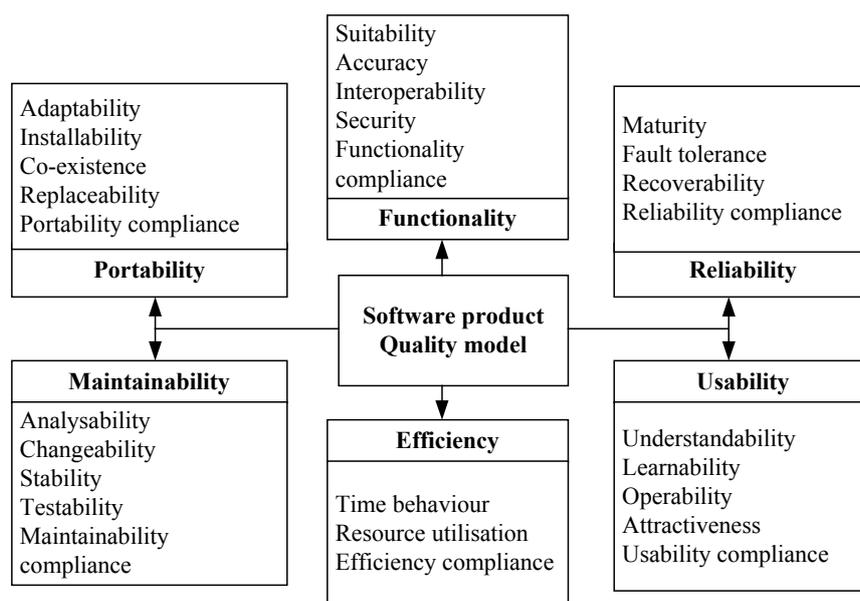


Figure 2. Software product quality model ISO 9126.

Quality characteristics of a model are related both to internal and external quality of software product. The same characteristics may be used, since the differences appear during measurement and type of applied metrics. Software product quality is defined by measuring its characteristics. The following notions are earmarked in the quality assurance of software product (ISO/IEC 15939, 2007):

- ◆ metrics – a definite method of measurement and scale of measures (metrics may be internal and external, direct and indirect; metrics include methods for categorisation of qualitative data);

- ◆ measurement – application of metrics to assign a value to an attribute of software product item from a definite scale (value may include either number or category);
- ◆ measure – value assigned to an attribute of an item during measurement;
- ◆ to measure – to define what amount of what specified quantitative unit exists.

Schematically a model for measurement of the software product quality is shown in Figure 3. The function of measurement ensures interpretation of quality characteristics, i.e. it assigns a definite value to an appropriate characteristic.

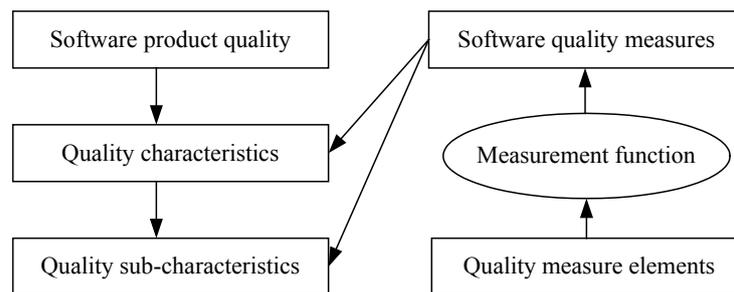


Figure 3. Software product quality measurement model (ISO/IEC 25030, 2007).

The author in her previous researches has demonstrated that ISO 9126 quality model and measurement process recommended by the standards may be applied in quality evaluation of a study programme (Sproge and Cevere, 2010). Similarly, as software product consists of various functions, a study programme consists of study courses. Every study course shall be evaluated to evaluate the whole programme. The characteristics of a quality model related to the study course are as follows:

- ◆ functionality – are all the required topics included into the study course;
- ◆ usability – is the study course easy to teach and to learn;

- ◆ efficiency – is the study course efficient, are the expected study results achieved;
- ◆ maintainability – is it easy to maintain the study course, are the necessary resources available;
- ◆ portability – is it easy to adapt the study course to another audience, is it easy to be modified.

Each higher education institution itself may choose content quality criteria for the programme evaluation. Metrics and quality characteristics for the external quality evaluation of a study course offered by the author are shown in Table 1.

Table 1

**Metrics and quality characteristics for the evaluation of a study course**

Metrics	Quality characteristics
Conformity of the delivered information to the defined content of the course	Functionality (functional suitability)
Conformity of the delivered information to a student’s expectations	Usability (suitability)
Understandability of the study course	Usability (understandability)
Quality of lectures	Functionality (suitability)
Quality of practical/ laboratory work	Functionality (suitability)
Proportion of lectures and practical/ laboratory work in the study course	Usability (suitability)
Quality of teaching aids of lectures/ practical/ laboratory work	Usability (learnability)
Availability and adequacy of the necessary literature to the study course requirements	Usability (learnability)
Understandability on the significance of the course	Usability (learnability)
Proportion of the necessary unassisted work for the particular course	Efficiency (time behaviour)
Relation of the content to another courses	Portability (co-existence)
Overlapping of the course information with other courses	Portability (co-existence)

The standards (ISO/IEC 9126-2, 2003) for the evaluation of software product quality characteristics provide various metrics according to internal and external characteristics of the quality model. By analogy, the author used a single

outline for the definition of metrics and interpretation of values for the evaluation of internal quality indicators of study courses. One example of metrics is described in Table 2.

Table 2

#### Outline for definition and evaluation of metrics

Purpose of the metrics	Does the content of study course conform to the initially defined?
Method of application	Count the number of negative estimations (very bad, bad, average) given in the questionnaire and compare it with the total number of estimations
Formula and data element computation	$X=1-A/B$ A – number of negative estimations B – total number of estimations
Interpretation of value	$0 \leq X \leq 1$ The closer to 1.0, the better
Metric scale type	Absolute
Measure type	A, B – count X – count/ count

### Results and Discussion

From the study year 2009/2010, the Faculty of Information Technologies has started a profound evaluation of external quality of study courses. The evaluation is undertaken by students as direct course users after each mastered course. Directly students are engaged in the programme implementation; hence, they are able to estimate a degree to which study courses delivered within the study

programme satisfy their defined needs and expectations. The polls of undergraduate students are carried out at the end of each term and students are asked to evaluate each mastered study course according to 10 criteria (metrics) providing a value from 1 to 5 (1 – shocking bad, 2 – bad, 3 – average, 4 – good, 5 – very well). The questionnaire is carried out electronically. Table 3 includes the information on the number of respondents and evaluated study courses.

Table 3

#### Data on students' polls

Academic year	Terms when students were polled	Total number of students	Number of respondents, %	Number of evaluated study courses
Autumn 2009	Term 1, Term 3	120	41 (34%)	16
Spring 2010	Term 2, Term 4	110	27 (25%)	21
Autumn 2010	Term 1, Term 3, Term 5	179	67 (37%)	35

Applying the sample of metrics described in Table 2, the obtained results on students' evaluations in each measurement process are depicted in Table 4. Total evaluation of study courses according to each metrics ranges between 0.60 and 0.84. If the author's proposed outline for interpreting of the measurement results is - the closer to 1, the better ( $0 \leq X \leq 1$ ), then the obtained results

show that the external quality of study courses shall be enhanced according to all mentioned characteristics. The highest evaluation is gained according to the first metrics – the delivered content of the course conforms to the defined content of the course, while the lowest evaluation is gained according to the eight metrics – adequacy and availability of the necessary literature to the study course requirements.

Table 4

**Total evaluation of the study courses**

No.	Metrics	Autumn 2009	Spring 2010	Autumn 2010
1	Conformity of the delivered information to the defined content of the course	0.80	0.84	0.81
2	Conformity of the delivered information to a student's expectations	0.71	0.78	0.74
3	Understandability of the study course	0.56	0.75	0.75
4	Quality of lectures	0.72	0.79	0.76
5	Quality of practical/ laboratory work	0.76	0.80	0.72
6	Proportion of lectures and practical/ laboratory work	0.73	0.81	0.84
7	Quality of teaching aids used in lectures/ practical/ laboratory work	0.71	0.74	0.72
8	Adequacy and availability of the necessary literature to the study course requirements	0.60	0.73	0.72
9	Understandability on the significance of the course	0.70	0.74	0.77
10	Proportion of the necessary unassisted work for the particular course	0.66	0.76	0.76

The target and quality characteristics for the evaluation shall be defined before starting a particular process of measurement. It is recommended to determine the proportion of these characteristics. None process of measurement simultaneously includes the evaluation of entire quality characteristics and sub-characteristics. External quality evaluation of study courses carried out

at the Faculty of Information Technologies is based on 3 characteristics and 6 sub-characteristics of the quality model (Table 5). Evaluation of characteristics ranges between 0.71 and 0.82. Evaluations have differed in every study year; however, a general tendency shows that the evaluation of quality characteristics increases with every next time of measurement.

Table 5

**Total evaluation of quality characteristics of the study courses**

Quality characteristics	Autumn 2009	Spring 2010	Autumn 2010	Total
Functionality (functional suitability)	0.80	0.84	0.81	0.82
Functionality (suitability)	0.74	0.79	0.74	0.76
Usability (suitability)	0.72	0.79	0.79	0.77
Usability (understandability)	0.63	0.74	0.76	0.71
Usability (learnability)	0.66	0.74	0.72	0.71
Efficiency (time behaviour)	0.66	0.76	0.72	0.71

The analysis of evaluation provided for the study courses of Autumn terms 2009 and 2010 (Figure 4) shows that the number of positive evaluations marked by students (4 – good, 5 – very well) is growing. It may be explained

by the fact that after each process of measurement, the academic staff receives a feedback on their study courses and it promotes the increase of the course quality.

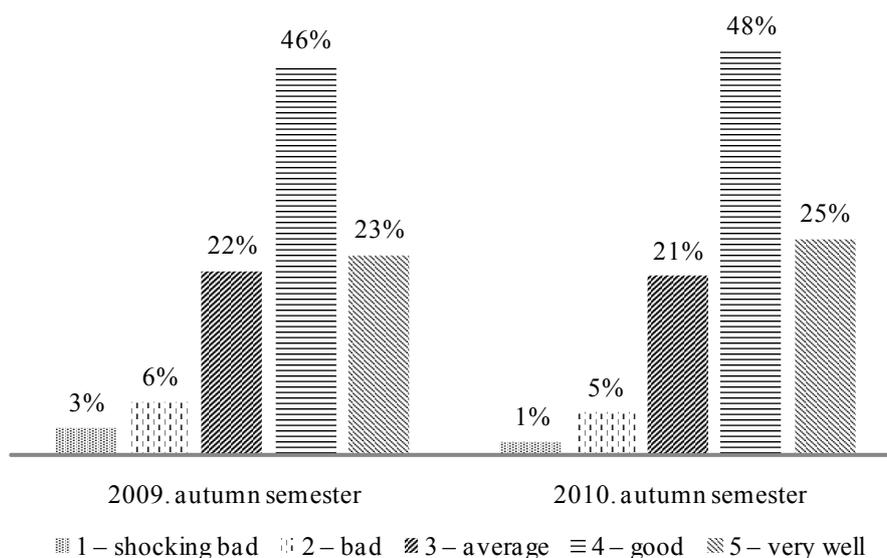


Figure 4. Evaluation of study courses by study years.

### Conclusions

1. Software product quality models and evaluation methods may be applied for the quality evaluation of a study programme, since by analogy software product and study programme are similar. Both products have internal and external quality.
2. Quality assurance of a study programme is under the competence of higher education institution itself. Students may be engaged in the evaluation of external quality of a study programme, since they participate in the implementation of the study programme and the content of the study programme facilitates the achievement of desired study results.
3. Engagement of students in the evaluation of external quality of a study programme shall be established as tradition of a higher education institution. Thus, students are involved in the improvement and strengthening of quality. Evaluation of study courses shall become an integral part of the study process.
4. Judgement on the general quality of study programme may be made after receiving the evaluation of completely all study courses included into the particular study programme. Currently the Faculty of Information Technologies has summarised evaluations for the study courses of the two first study years.
5. Feedback shall be established after each evaluation process – both the academic staff and students shall have the possibility to be acquainted with the course evaluation.
6. Evaluation of internal quality of a study programme shall be carried out along with the evaluation of its external quality, thus forming the quality culture of a higher education institution.

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