A Model and an Index for e-Learning Quality Assessment

Yulka Petkova, Denica Radeva

Abstract: *A model for obtaining a generalised quantitative assessment of the quality of e-Learning is presented in the report. The quantitative assessment is calculated by the means of geometric index, applied on different factors (characteristics), sub-factors and for final generalised assessment. The suggested model was applied to the data for the student satisfaction with the platform for distance learning in the Technical University of Varna, Bulgaria.*

Key words: *E-Learning; Quality of E-Learning; geometric index*

INTRODUCTION

The place and importance of e-Learning in today's world of ubiquitous globalization and rapidly evolving technologies is undoubtedly. Traditional "face-to-face" training is increasingly shifting by "anytime, anywhere and anyone" e-Learning. It is very important its quality to be complex valued and analyzed, in order to determine the direction of its development.

Nowadays number of standards, specifications and recommendations related to the quality of e-Learning is growing up. Created by different organizations they offer a common framework for regulating the different aspects related to the management and assessment of the quality in virtual education. The main aim of these standards is to improve the quality of products, services or e-Learning systems [7]. Some of these standards are: CWA 15533:2006, A model for the classification of quality approaches in e-Learning; CWA 15660:2007, Providing good practice for e-Learning quality approaches; CWA 15661:2007, Providing e-Learning supplies transparency profiles, issued by CEN (European Committee for Standardisation); ISO/IEC 19796-1:2005, ITLET Quality management, assurance and metrics, Part 1 – General approach; ISO/IEC 19796-3:2005, ITLET Quality management, assurance and metrics, Part 3 – Reference metrics and methods, issued by ISO (International Organization for Standardization) and other.

To ensure quality learning many organizations, universities and educators have developed various quality measures, methodologies and programs for e-Learning evaluation [3], [4], [9], [10], [13] and many others.

Two types of quality evaluation programs are considered in [2] – e-Learning Service Certification program (eLSC) and e-Learning Courseware Certification program (eLCC). The author also presents two quality frameworks – eLQA and eLSC for e-Learning quality assessments, concluding that there is a necessity of improving them in order to achieve more generalized evaluation, taking into consideration a wide variety of indicators.

A. K. Agaria and D. Singh [1] propose a methodology, based on analysing the results received by depth interviews with the students and faculty members of different universities. They use two questionnaires: from learner's perspective (including 30 survey items) and from faculty perspective (including 28 survey items) and five-point Liker-scale – from 1 = strongly disagree to 5 = strongly agree. They have developed two measurement scales based on five factors from perception of both learner and faculty for measuring service quality of e-Learning providers. From learner's point of view the major factors are: Course content, Design structure, Collaboration, Industry acceptance and Value addition. From faculty point of view the corresponding five factors are: Course content, Design structure, Transparency in assessment, Technical know-how and Engagement (from students).

Jia Frydenberg [6] summarises current published quality standards in USA and analyses and organises them into a mine-cell matrix including following nine domains: Institutional Commitment, Technological Infrastructure, Student services, Instructional

Design and Course Development, Instruction and Instructional Services, Delivery, Finances, Regulatory and Legal Requirements Program Evaluation.

In [11] authors also analyse and suggest e-Learning course quality factors, divided and subdivided into the following categories: Relevance of information, Learning process (Subcategories: Curriculum; Methods of learning); E-Learning environment (Subcategories: Supporting learners; Interface); Learners' personal experience and initial competence (Subcategories: Competence in foreign language, Previous experience in e-Learning).

Insung Jung [8] suggests the following six factors for evaluation: Relevance of course contents and delivery; Effectiveness of delivery mode; Instructor support and Students' commitment; Web-usage and on-line interaction; Course compliance and confidence in the system; Relevance of testing instruments and grading. He uses statistical approach for e-Learning quality evaluation. In his study [6] Insung Jung presents the dimensions of e-Learning quality from the learner's perspective. He involves seven dimensions in evaluation: Interaction, Staff support, Institutional quality assurance mechanism, Institutional credibility, Learner support, Information and publicity and learning tasks. Factor analysis based on unweighted least squares as an extraction method and Promax with Kaiser normalization as a rotation method is used to evaluate correlation between seven factors measuring learner perception of e-Learning quality.

Based on the short survey we can conclude that most of methodologies are concentrated on almost the same (usually seven) criteria for e-Learning quality evaluation. We can't say the same about the methods for quantitative evaluation of the quality.

In this study we accept the concept of the above seven (or more) evaluation criteria. But we focus on the measures for quantitative assessment of the e-Learning quality.

SUGGESTION FOR QUANTITATIVE ASSESSMENT OF e-LEARNING QUALITY

According to [12] quality indices can be divided into two categories – single and complex. The single index corresponds to only one feature of the learning and it is connected with the quality by a strongly monotonic dependence with a positive or negative ingredient. On the other side complex indices can be divided into other two categories – group and generalized. Group indices take into consideration just a few features, than the generalised which include all the characteristics of the learning.

The authors [12] present four indices for quantitative quality evaluation: quadratic, geometric, arithmetic and harmonic. He concludes that geometric index is the most optimal one for generalized quantitative e-Learning quality evaluation due to the satisfaction of the following conditions: monotony, consistency, comparability and normalisation.

$$K_G = \left(\prod_{i=1}^{N} d_i^{b_i} \right)^{\frac{1}{\sum_{i=1}^{N} b_i}} \quad (1)$$

where:

N – number of criteria taking part in the quality estimation

d_i – normalised rating for each criterion; $0 < d_i \leq 1$

b_i – weight of each rating

$\sum w_i = 1$.

In this study we accept the idea of using geometric index for quantitative quality assessment. We propose a tree of quality parameters (criteria) to be constructed and the same indices to be applied many times, over each branch of the tree. This is formally presented in figure 1.

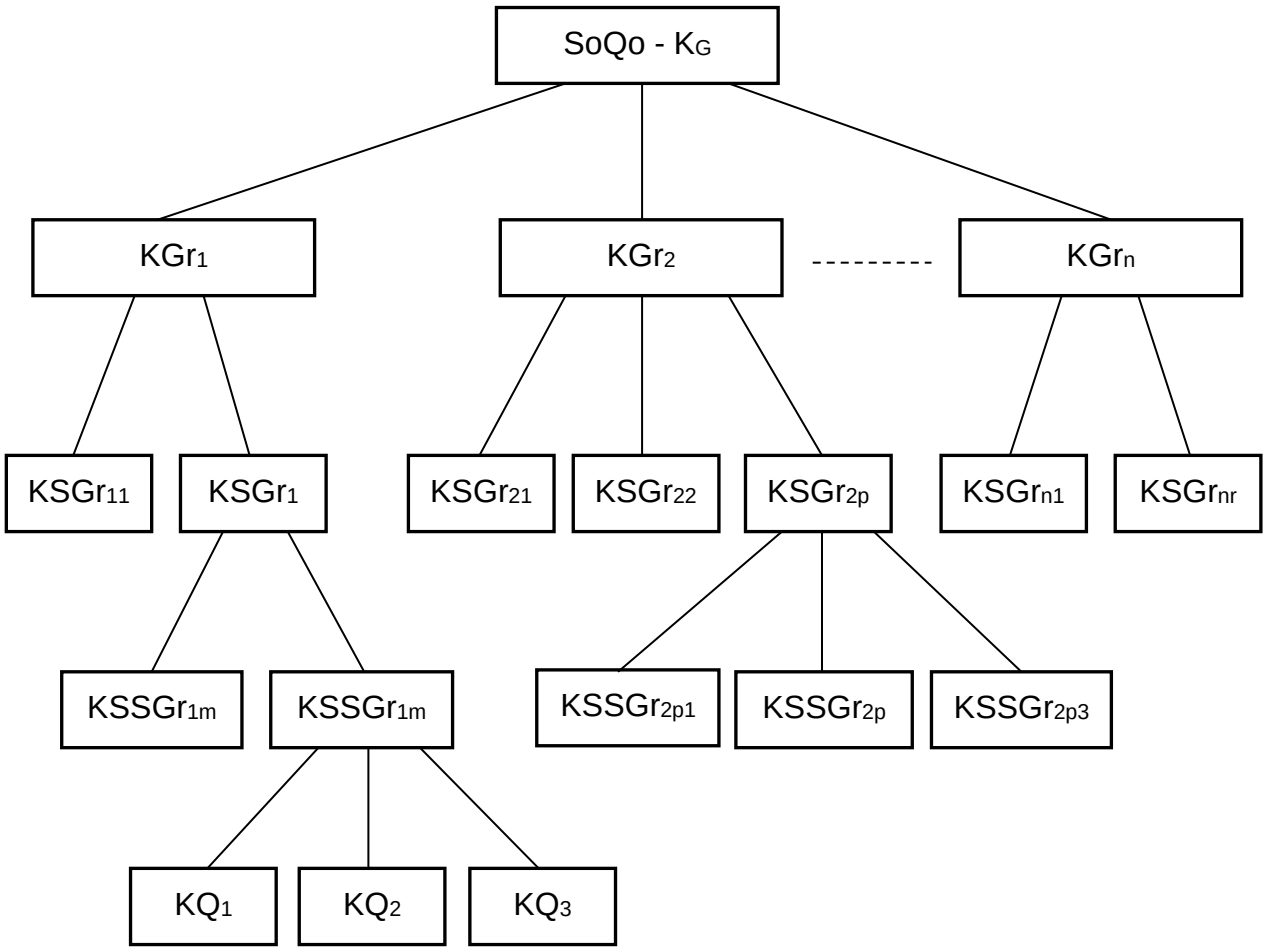

Fig. 1. A model for generalized quantitative quality evaluation

SoQo – K_G means "Satisfaction of quality – geometric index);
KGr – group of criteria;
KSGr – subgroup of criteria;
KSSGr – sub-subgroup of criteria;
KQ – geometric index of the smallest unit in the tree.

Adding new branches in the tree is very easy keeping the structure and applying the same geometric index for quality assessment.

GENERALIZED MODEL AND GEOMETRIC INDEX FOR QUANTITATIVE QUALITY ESTIMATION APPLIED TO THE DISTANCE LEARNING PLATFORM IN THE TECHNICAL UNIVERSITY OF VARNA

The proposed model is applied to estimate the quality of distance learning platform in the Technical University of Varna.

As initial data we use a collection of answers of questionnaire, containing 14 questions, divided into four groups. Questions about age, education, sex, speciality and others are also included in the questionnaire, but their answers don't contribute to the quality assessment and they are not taken into consideration.

The first group of questions is about the accessibility of the platform for distance learning and contains four questions. The second one contains five questions connected with the given learning materials (theoretical bases, examples, tests, etc.). Group 3 contains four questions about a willingness to apply for distance learning for different degrees and subjects. Group 4 consists of only one question about if it is easy to contact teacher in case of necessity of advice and explications.

Students gave their assessments using the following five-step scale (see figure 2):

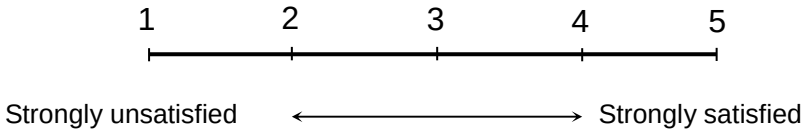

Fig. 2. Five-step assessment scale

The above proposed generalized model and index for quantitative quality assessment, applied to the distance learning platform in the Technical University of Varna is shown in figure 3.

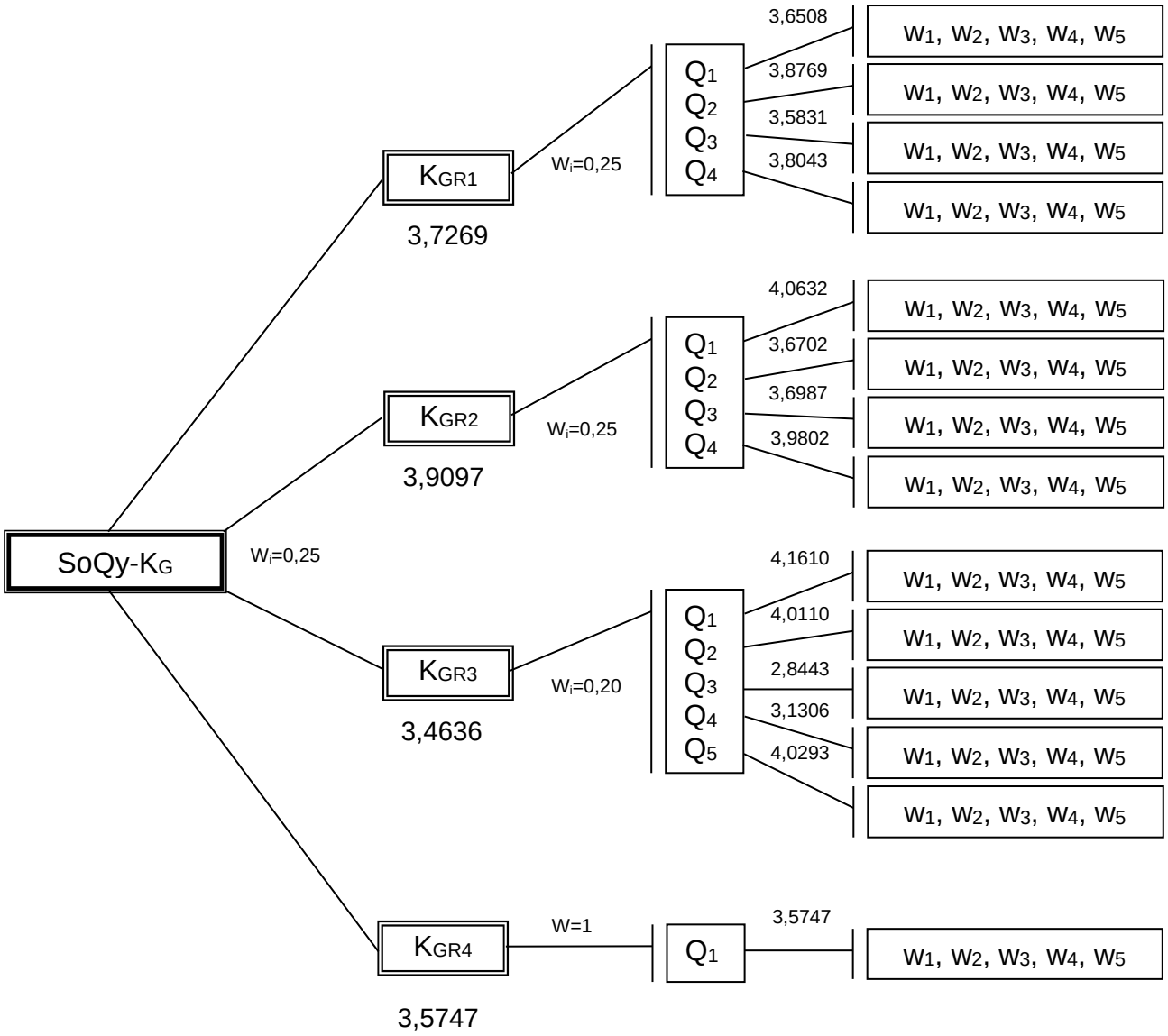

Fig. 3. Generalized model for quality estimation applied to the distance learning platform in the Technical University of Varna

In this model Q_i are assessments of the questions (criteria), and w_i are weights for each question (criterion) or group of questions (criteria).

For every question (criterion) in the group:

$$K_q = \left(\prod_{i=1}^{Q} n_{o_i}^{w_i} \right)^{\frac{1}{\sum_{i=1}^{Q} w_i}} \quad (2)$$

where:
Q – number of criteria
n_{oi} – normalised rating for each criterion; $0 < n_{oi} \leq 1$
w_i – weight of each rating
$\sum w_i = 1$.

For every group of questions (criteria):

$$K_{GR} = \left(\prod_{j=1}^{N} K_{Gq_j}^{w_{q_j}} \right)^{\frac{1}{\sum_{j=1}^{N} w_{q_j}}} \quad (3)$$

where:
N – number of questions (criteria) in the group
K_{Gqj} – normalised rating for each question (type of answers); $0 < K_{Gqj} \leq 1$
w_{qj} – weight of each rating
$\sum w_{q_j} = 1$.

Generalized rating SoQy is:

$$SoQy - K_G = \left(\prod_{m=1}^{P} K_{GR_m}^{w_{g_m}} \right)^{\frac{1}{\sum_{m=1}^{P} w_{g_m}}} \quad (4)$$

where:
P – number of groups in the questionnaire
K_{GRm} – normalised generalised rating (assessment) of each group of questions
$0 < K_{GRm} \leq 1$
W_{gm} – weight of each rating
$\sum w_{g_m} = 1$.

Finally, the generalised quality assessment is 3,99, which corresponds to "satisfied" category, using the five-step assessment scale.

The initial data, used in this study are received from an inquiry into students' satisfaction by the platform for distance learning in the Technical University of Varna. The inquiry was done within the project BG 051PO001-4.3.04-0014 of the HR Development OP of the European Social Fund 2007-2013.

CONCLUSIONS

The quantitative assessment of the quality of e-Learning is compulsory and very important in order to overcome the disadvantages and improve this method of learning.

The suggested assessment scheme together with the geometrical index for its quantitative expression can be successfully applied both for the assessment of the e-Learning quality and other kind of learning methods. Another positive feature of the proposed model is that we can also analyse middle (group or subgroup) results and we can influence of them, correcting conditions they are due. It's not a problem to add new branches into the tree structure in order to receive as soon as an accurate assessment of the quality.

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ABOUT THE AUTHORS

Assist. Prof. Yulka Petkova, PhD, Computer Science and Engineering Department, Technical University of Varna, Phone: +359 52 383 403, E-mail: yulka.petkova@tu-varna.bg

Denica Radeva, student, President of Student Council, Technical University of Varna, E-mail: denica.radeva@gmail.com

The paper has been reviewed.