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Online Self-Assessment System Based on Structure-Oriented Evaluation Model

Bayar-Erdene Lkhagvasuren[1], Uranchimeg Tudevdagva[2]

[1]Mongolian University of Science and Technology, E and Open Institution, Baga Toiruu, Sukhbaatar District, Ulaanbaatar-14191, Mongolia

[2]School of Power Engineering, Mongolian University of Science and Technology, Faculty of Computer Science, Chemnitz University of Technology, Straße der Nationen 62, D-09111 Chemnitz, Germany

Abstract: ***This paper describes main concept of online self-assessment system. The system developed for performance evaluation of faculty members (teaching staff) of Mongolian University of Science and Technology (MUST). Quality of the higher education depends on many factors. One of the important factor for this is quality of faculty members. The MUST recognized this issue early and organizes different type of activities and processes to support development of faculty. There are various ways to motivate faculty members. An evaluation of performance is one way to support faculty development. The MUST opened opportunity to measure own success and find weakness of performance for faculty members. Since 2008, some researchers of MUST started to work on faculty evaluation process and tried to establish basic criteria for performance evaluation. As result of that study in 2001, first time in MUST did attestations of faculty members. Meantime all process happened paper based version. From designing to reporting of attestations did manually. Came up many questions and discussion in university in different level. Main feedback from that evaluation process showed, need of scientific evaluation model for evaluation of faculty. It became basic motivation of this work and we tried to develop self-assessment system for faculty members with transparent theoretical background. Advantage of offering system is well-defined structure oriented evaluation model and system is fully online. First time author applied structure oriented evaluation model in faculty evaluation. Moreover, produced test code of system with client-server design for online version.***

Keywords: performance evaluation, faculty evaluation, logical structure, evaluation design, calculation rules

1. Introduction

Faculty evaluation is one of the very complex task. There are many reasons and targets to do faculty evaluation. Understanding evaluation as currently practiced requires some appreciation of its history, its distinguishing concepts and purposes, and the inherent tensions and challenges that shape its practice [1].

Mongolian University of Science and Technology (MUST) is fundamental technical university for engineering science in Mongolia. Most portion of engineers graduated in MUST. Therefore, social responsibility of MUST before country development is enough high. Graduate students of MUST immediately can move to various field of industry. That means our students have to learn all necessary theoretical knowledge and practical skills during their study.

Main core for quality in university is skills and motivation of faculty members. If any university has excellent faculties, this can become some kind of insurance for quality of that university.

In the MUST happening many activities to support faculty members. One of these activities is “Attestation” process. From 2011 to 2015 every two years university measured performance of faculty members via attestation process. Result of this process directly linked to position stages and salary levels. This was some idea to motivate faculty members to develop their personal and professional skills. Results of evaluation process confirmed that idea is correct. But with feedback came in light way to evaluate faculty members is not efficient for many cases and faculty members expect more scientific and transparent evaluation system from university.

Such us requests were motivation of this study. In this research, we developed online self-assessment system for faculty members. Evaluation system based on structure-oriented evaluation model. Scientific background of this model proofed by several doctoral thesis for e-learning and robostnuss evaluation. New aspect of our research is we are first time applying structure-oriented evaluation model for faculty evaluation process.

2. Structure Oriented Evaluation Model

The structure oriented evaluation model originally developed for evaluation of e-learning [2]. This model included steps of evaluation process from planning, designing through data processing to result reporting. Important point of structure oriented evaluation model is data processing part. Evaluation planning process directly linked to calculation rules of collected data. This was main reason to select this evaluation model as base for online self-assessment of faculty development [3].

The SURE model consists of eight steps. All steps of structure oriented evaluation model have a specific meaning. Output of the previous step will become the input of next step [4]. These are the eight steps of SURE model:

- Definition of key goals
- Definition of sub goals
- Confirmation of evaluation goals
- Creation of checklist
- Acceptance of checklist
- Data collection
- Data processing
- The evaluation report

Advantage of this model is logical relation between evaluation goal and data processing. As usually, all above mentioned evaluation steps developed separately and evaluation team have to combine various type of evaluation method and models together in one evaluation process. Instructure-oriented evaluation model all united in one integrated process. Important is here each step logically linked one to other and this is very transparent via logical structure and calculation rules. That means all steps of evaluation are clear, understandable and traceable for every involved groups: administration, faculty member, stakeholders and others.

The theoretical basis of structure oriented evaluation model forms the general measure theory. The idea is that, if one wants to evaluate or measure how faculty member has achieved its performance goal, which should done in line with measure theoretical rules and principles as they are used in proven manner in geometrical context at measurement of lengths, areas or volumes, in natural sciences and in probability theory, for instance.

3. Steps of Evaluation Model

3.1 Key goals

This is traditional order to start complex evaluation process. Evaluation have to do with certain target (goal). In this step have to define this basic goal (aim) of evaluation. New aspect in structure oriented evaluation model is visualized these goals us *serial logical structure*(Fig.1).

Figure 1: Structure for main goals

For example, in Fig.1 defined *n* main goal and it visualized as serial logical structure. Why serial? Serial means this evaluation will be successful if each of this goal will evaluated as successful. If any of this goal failed, then whole process will be summarize as failed.

3.2 Sub goals

Difference of structure oriented evaluation model from similar models is opportunity to define sub goals for evaluation process. These sub goals embedded over key goals into a main goal. All sub goals contribute to the success of main goal. Between sub goals, consist logical relations, which describe how the sub goals have influence to achieving of the main goal.

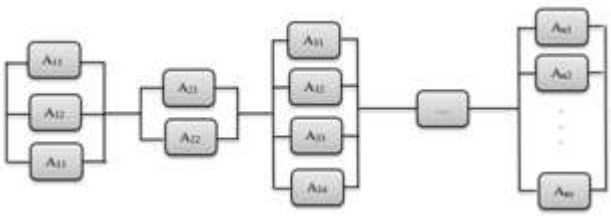

Figure 2: Structure for sub goals

Sub goals visualized via *parallel logical structure* (Fig.2). Why parallel? Parallel means, if any one of these sub goals evaluated as successful then corresponding main goal will evaluated successful, too.

3.3 Confirmation step

By our observation many evaluation process has one gap. This is the confirmation document about evaluation goal. It is very formal process but this should include officially into evaluation process as one-step. In thirds step of structure oriented evaluation model have to generate *confirmation document*. How can do it? Why we need it? In first two steps defined main and sub goals. In this step, these structures have to send to all involved groups of evaluation. Each group have to check and discuss goals in own way and then have to give feedback as confirmation. If cannot be agree with any goals from structure have to review goal structures and again have to send to all involved groups. Here should repeat this process repeatedly until full agreement of all involved process. We need it, because if involved groups cannot accept evaluation goals then later they will not accept result of evaluation. Therefore, we need to recognize weakness of evaluation goal before to collect data for evaluation.

3.4 The checklist

This is one of the well-developed part of evaluation models and methods. There are many opportunities to generate checklist or survey automatically: fluidsurveys [5], iPerceptions [6], free online survey [7], kwiksurvey [8], easy polls [9], survey planet [10], Sogo survey [11], eSurveypro [12], esurvey creator [13], Stellarsurvey [14], Questionpro [15], esurvey [16], questionform [17], panel place [18], survey crest [19], addpoll [20] and Quick surveys [21], for instance. Table 1 shows draft of checklist design.

3.5 Acceptance of checklist

This is the next new point of structure oriented evaluation model. Developed checklist should send to all involved groups and each group have to test these questions in practice. Arrangement, style, dual meaning, spelling etc. from all aspects every group have to check by them self and after that have to return acceptance document about checklist. If have any point in checklist have to send feedback to evaluation team and team have to improve checklist by corresponding hints. After update of checklist, again have to send to all involve groups' checklist. Until acceptance of all involved group this process has to repeat.

Table 1: Checklist draft

Main goal	*Sub goal*	*Question*
A1	A_{11}	Comprehensive knowledge in the teaching field
	A_{12}	Presentation skills
	A_{13}	Communication with students
	A_{21}	Class management and preparation
A2	A_{22}	Quality of teaching materials
	A_{31}	Teaching effectiveness
	A_{32}	Passion for teaching
A3	A_{33}	Research and scientific achievement

	A_{34}	Reputation
…	…	…
An	A_{n1}	Administrative skills
	A_{n2}	Service to professional societies
	…	…
	A_{ns}	Professional activities in the community

3.6 Data collection

Self-assessment system will collect data from faculty member by online. Online system has to be design flexible manner. Faculty member has opportunity to access to self-assessment system from all type mobile devices: smart phones, pads and notebooks. Moreover, system should work on all type of internet browser. These are tasks for software engineers but here evaluation team have to support software developers with contact feedback and remarks during deployment time.

3.7 Data processing

Structure oriented evaluation model has pre-defined calculation rules for data processing. This is the basic principle of data processing: Let us consider an evaluation structure C which consists of r key goals B_i, $i = 1, \dots, r$,where each key goal is defined by$s_i$sub goalsA_{ij}, $i = 1, \dots, r$, $j=1,\dots,s_i$.Let us suppose that we have obtained$n$checklist data records via a checklist adapted to goal structure.
Let$[x_{ij}^{'}, x_{ij}^{''}], x_{ij}^{'}, \leq x_{ij}^{''}$, be the evaluation interval of checklist forevaluation how the aim of sub goalsA_{ij} has been achieved. The empirical score$Q^*(C)$ for evaluation of goal structure Ccalculatedby (1)

$$Q^*(C) = \frac{1}{n}\sum_{k=1}^{n} Q^{*(k)}(C) = \frac{1}{n}\sum_{k=1}^{n}\prod_{i=1}^{r}\left(1 - \prod_{j=1}^{s_i}\left(1 - q_{ij}^{*(k)}\right)\right). \quad (1)$$

Here $q_{ij}^{*(k)}$ denotes for$k = 1, \dots, n$,the empirical score for sub goalA_{ij} according the k^{th} checklist result. This value is obtained by normalization of checklist value$k_{ij}^{(k)}$, where$k_{ij}^{(k)}$is the obtained score or answer of k^{th} applicant to checklist question how the sub goal A_{ij} has been achieved.
How this formula obtained and how we have to interpret the empirical score$Q^*(C)$is discussed in [2].

3.8 Reporting

Once evaluation done coming very important step of evaluation process. This is the reporting part. Result of evaluation process should deliver in good time to corresponding groups in different ways. Result visibility can be different for involved groups. For example as stakeholder, university board can be see all detailed results of evaluation process. As faculty member must be able to see own result immediately after filling all requested criteria of self-assessment system. As employer faculty dean or professors can be see result of own faculty members. Moreover, society or students can be see some result of whole evaluation of university.
Type of report can be different, too. Smart chart, designed table, statistic data all possible to deliver result of evaluation.

4. Online self-assessment system

Online system for self-assessment consists of three main functions:
- Evaluation
- User
- Admin

In evaluation, function defined main and sub goals of evaluation as structure. Single structure linked to detailed criteria. By drag and drop interface admin can design evaluation goal structure in flex able way. The evaluation function has database for criteria and structure. That means all defined criteria or structure will stay in database of evaluation function and later can re-used for new design of evaluation goal structure.

User function defined for faculty member who is applying for self-assessment. In this function defined several objects: database for user information, folder documents for upload, account manager, user interface manager etc. Each user should use faculty member number as account for access. Access password will generate automatically in first attemp and later can changed by user. User can finish application by one access or if it necessary can leave application not yet finished. In such situation, system will memorize actual state of application and later user any time can return to application and continue from state where was leaved system.

Admin function is most important function in the system. This function leads whole system and have all right to change and update of system.

5. Conclusion

In modern life, education became hot topic for each country. Educated personals contributing a lot to many fields of infrastructures and others of country. Relating to this quality of higher education attracting many researchers' interest and educational institutions giving high attention to this issue. One of the basic factor for quality of higher education is quality of teaching staff – faculty performance.

To evaluate performance of faculty members Mongolian University of Science Technology establishing online self-assessment system with scientific evaluation method. Basic of online self-assessment system of MUST is structure oriented evaluation model. In this model, defined eight steps of evaluation process and all steps united with logical background. Output of previous step defining as input to next step. All steps discussed in this paper with short description.

We developed web based online system for self-assessment and it is now open for faculty members. We are looking to first result in end of this year.

References

[1] P.H.Ross, M.W.Ellipse, and H.E.Freeman, "Evaluation: A systematic approach", (7th ed.). Thousand Oaks: Sage, 2004.
[2] U.Tudevdagva, "Structure Oriented Evaluation Model for E-Learning". Wissenschaftliche Schriftenreihe Eingebettete Selbstorganisierende Systeme, Universitätsverlag Chemnitz, Chemnitz, Germany, July 2014. 123 p., ISBN: 978-3-944640-20-4, ISSN: 2196-3932.
[3] U.Tudevdagva and B.Lkhagvasuren, "Application of the structure oriented evaluation model for faculty members self-assessment", In Proceedings of the IEEE conference, 11th International Forum on Strategic Technology (IFOST), pp.448-451, 2016. DOI: 10.1109/IFOST.2016.7884292
[4] Tudevdagva,U. et al., (2012). "New Approach for E-Learning Evaluation", in Proceedings of the 7th International Forum on Strategic Technology, Tomsk, Russia, pp.712-715.
[5] Survey Software, Fluid Surveys, [Online]. Available: http://fluidsurveys.com/
[6] Survey Software, Iperceptions, [Online]. Available: http://signup.
[7] iperceptions.com/online-survey. tml?gclid=CPqAg63g-LgCFYKS3god1GAAUg
[8] Survey Software, Free online surveys, [Online]. Available: http://freeonlinesurveys.com/
[9] Survey Software, Kwik Survey, [Online]. Available: http://kwiksurveys.com/
[10] Survey Software, Easy polls, [Online]. Available: http://www.easypolls.net/
[11] Survey Software, Survey planet, [Online]. Available: https://www.surveyplanet.com/
[12] Survey Software, Sogo survey, [Online]. Available: http://www.sogosurvey.com/
[13] Survey Software, Esurveyspro, [Online]. Available: http://www.esurveyspro.com/free-online-survey.aspx
[14] Survey Software, Esurvey creator, [Online]. Available: https://www.esurveycreator.com
[15] Survey Software, Stellar survey, [Online]. Available: http://stellarsurvey.com/
[16] Survey Software, Questionpro, [Online]. Available: http://www.questionpro.com/
[17] Survey Software, Esurvey, [Online]. Available: http://esurv.org/
[18] Survey Software, Questionform, [Online]. Available: http://questionform.com/
[19] Survey Software, Panelplace, [Online]. Available: http://www.panelplace.com/
[20] Survey Software, Surveycrest, [Online]. Available: http://www.surveycrest.com/
[21] Survey Software, Addpoll, [Online]. Available: http://www.addpoll.com/
[22] Survey Software, Quick Surveys, [Online]. Available: https://www.quicksurveys.com/

Author Profile

Bayar-Erdene Lkhagvasuren received the B.S. and M.S. degrees in Information Technology from Mongolian University of Science and Technology in 1996 and 2003, respectively. He studies the system and modeling, his master's degree in this field. Since 2000, he has been working as a researcher, specialist, and teacher in Mongolian University of Science and Technology.

Uranchimeg Tudevdagva received the B.S. degrees in Computer Engineering from Electro Technical University of Novosibirsk, Russia in 1992 and M.S. degrees in Electrical Engineering from Mongolian University of Science and Technology (MUST), Mongolia in 1997, respectively. Later she received PhD in Computer Science from Novosibirsk State Technical University, Russia in 2004 and ScD (Dr.-Ing.habil) degree from Chemnitz University of Technology, Germany in 2014. Since 1992, she working in MUST, Mongolia. She made long careers from assistant lecturer to Professor and Researcher in MUST. She is the expert in man-machine systems, human computer interaction, e-learning and distance learning, evaluation theory and evaluation model. She now with Chemnitz University of Technology, Germany.