Assessing Teacher's Teaching Quality in Higher Education: a Preliminary Study

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Abstract - *This study presents a preliminary framework that is designed to address teachers' teaching quality (TQ) in terms of teaching capability and maturity. The framework is developed for the assessment to be based on T-CMM. The process design of the framework applies the concepts of SCAMPI that is from software industry. Because of interdisciplinary study, in this paper we focus on reviewing the applicability of the interdisciplinary application and establishing a draft framework. While existing educational appraisals that mainly emphasize organizations, the proposed assessment framework is designed to further link and accredit TQ to teachers. It is hoped that by presenting this preliminary work in this prestigious conference, more constructive and valuable comments and suggestions can be obtained for the future development of the individualized TQ assessment research.*

Keywords: Higher education, teaching quality, teaching capability maturity

1 Introduction

Like any organization that stresses the importance of quality management, schools are also responsible for providing quality teaching. In higher education, teaching quality (TQ) is also a primary focus. To address TQ in higher education, besides existing methods and standards that focus mostly on the organizational level, attention should also put to teachers who executively determine TQ. In addition to the call on teachers, process also plays a critical role in quality teaching (Grant et al., 2004; Louden, 2000). Yet existing evaluations on a teacher's TQ, such as course evaluations or peer review, largely depend on students' subjective feeling or the teacher's momentary performance during the peer visit (*Cramer* and *Alexitch*, 2000; Marsh and Roche, 1997). This is sometimes too judgmental or partial, neglecting other efforts a teacher may have made during the processes of the entire course.

In the area of process-focus teaching quality, recent study has developed a Teaching Capability Maturity Model (T-CMM) (Chen et al., 2014; Chen et al., 2011). T-CMM is designed to address TQ by comprehensively covering the endeavors of a teacher in the lifecycle of instructing a course. Basing on T-CMM, we focuses further on the assessment for determining teaching capability and maturity. This is motivated by the fact that T-CMM provides a gradual way for a teacher to continually improve TQ, yet it requires a means for identifying where (i.e. the level of capability or maturity of teaching) of the teacher on the roadmap to superior quality of teaching. Therefore, this study presents a preliminary assessment framework that is based on T-CMM. The proposed TQ assessment framework is designed for individualized (i.e. teachers) usage of teaching capability/maturity assessment; and it differentiates the organizational scope in traditional appraisals.

The entire research of TQ assessment framework comprises two parts: a conceptual study of the applicability review of the framework, and the development and implementation of the framework. This paper serves as the first part, as well as for acquiring suggestions and comments for the next stage of development. Because the framework applies the concepts of SCAMPI that is from software industry, in this paper we focus on reviewing the applicability and then deriving the proposed design features. The rest of this paper is organized as follows: Section 2 reviews the teachers' teaching capability maturity (T-CMM) model; Section 3 reviews SCAMPI; Section 4 introduces the current development of the proposed TQ assessment framework, including the applicability analysis and the process draft design; Section 5 discusses the framework; Section 6 brings up the upcoming research of the TQ assessment framework.

2 Teaching Capability Maturity Model

The Teaching Capability Maturity Model (T-CMM) (Chen et al., 2014; Chen et al., 2011) was establish based on the need of focusing on teachers and their teaching processes, not just solely the in-class performance. T-CMM is an interdisciplinary application; it applies the concepts of CMMI that is from the software industry to the management of TQ in higher education. From the process aspect, the core activities or so-called building blocks in teaching can be modeled based on the curriculum lifecycle of the course. In T-CMM, these building blocks refer to common teaching process areas

(TPAs). Each TPA has specific goals (SG) for a teacher to achieve in implementing the TPA. Table 1 below displays the collection of TPAs and the associated SGs, which are identified from the survey of literature in educational service and higher education.

Table 1: The TPAs in T-CMM (Chen et al., 2014)

Note: For the references that support the contents of TPAs, see: Chen, C.Y., Chen, P.C., & Chen. P.Y. (2014) Teaching quality in higher education: an introductory review on a process-oriented teaching-quality model, *Total Quality Management & Business Excellence*, 25(1) 36-56

TPA	TML	Specific Goals (SG)
Course and Teaching Planning (CTP)	2	SG1 Identify course scope (Barnett, 1992; Brennan et al, 1997) SG2 Establish and maintain a course plan (Ramsden, 2003, SEI, 2011)
Course Requirement Development (CRD)	2	SG1 Develop course requirements (Barnett, 1992; Popham, 1993) SG2 Maintain the requirements (Miller, 1974)
Course Monitoring & Control (CMC)	2	SG1 Monitor & control the course against the plan (Marzano et al., 2005; Martin et al., 2004; Ramsden, 2003; ACM, 2002; Lawn, 1991) SG2 Resolve issues and manage to closure (SEI, 2011) SG3 Manage classroom atmosphere (Brooks, 1994; Marzano et al., 2005)
Course Contents Management (CM)	2	SG1 Establish course configuration (Lutteroth et al., 2007; Ramsden, 2003; Harvey, 1993)
Learning Verification & Teaching Validation (VAL)	3	SG1 Prepare for evaluation (Prince & Felder, 2007; Bloom et al., 1981; Cramer & Alexitch, 2000) SG2 Conduct the evaluation (Bloom et al., 1981; Dill, 1997; Dressel, 1976; Marsh and Roche, 1997; McKeachie, 1997; Prince and Felder, 2007)
Integrated Course & Teaching Management (ICTM)	3	SG1 Establish defined teaching process (Srikanthan & Dalrymple, 2005; Miller, 1974; Trigwell and Prosser, 1991) SG2 Collaborate with other teaching stakeholders (Chen, 2009; SEI, 2011) SG3 Maintain a shared vision with the organization and collaborative stakeholders (SEI, 2011; Trigwell and Prosser, 1991)
Teaching Process Focus (TPF)	3	SG1 Find out teaching or learning related problems (Daigle et al., 2003; Probst et al., 2002) SG2 Establish teaching assets (SEI, 2011, Harvey, 1993; Seidin, 1997)
Quantitative Course Management (QCM)	4	SG1 Establish quantitative quality goals (Brooks, 1994; SEI, 2011) SG2 Manage teaching/learning performance (Marzano et al., 2005; SEI, 2011)
Quantitative Process Management (QPM)	4	SG1 Establish quantitative process goals (Brooks, 1994; Ramsden, 2003; Wilson, 1998) SG2 Manage process performance by numbers (Ramsden, 2003; Wilson, 1998)
Teaching Innovation (TIA)	5	SG1 Establish the environment for teaching innovation (Brooks, 1994; Costantino and Lorenzo, 2000; SEI, 2011) SG2 Review the results of innovative changes (Ramsden, 2003; SEI, 2011)

Based on the establishment of TPA, T-CMM defines six levels of teaching capability and five levels of teaching maturity. Teaching capability level (TCL) refers to how well a teacher performs and sustains the performance of a particular TPA. Teaching maturity levels (TML) refer to the stages in which corresponding TPAs converge for a teacher to implement, in order to achieve an overall teaching performance. The capability level of a particular TPA is determined by implementing the SGs for the TPA and the GG (the goals to sustain the implementation results) associated with the TCL. The maturity level is determined by implementing a set of the TPA that are constellated in the level and achieving the GG that is associated with the TML. Table 1 also displays the constellation (in terms of TML) of identified TPAs. The collection of teaching process areas represents the systematic and comprehensive perspective regarding a teacher's teaching profile/portfolio. Refer to (Chen et al., 2012) for the detailed specific practices (SP) for the SGs in a TPA.

In aspects of the two level representations, a teacher or the teaching team (i.e. with teaching assistants) may implement a group of TPAs collectively in order to reach a quality plateau. Each stage/plateau (i.e. TML) defines an overall topic (e.g. "basic course management" of TML-2) of teaching quality and is associated with related TPAs for the teacher to implement collectively. Alternatively, a teacher can focus on individual TPAs. Such an implementation effort is relatively smaller but remains continuous till all TPAs are

implemented and GGs are achieved. Figure 1 below denotes the levels of teaching capability and maturity.

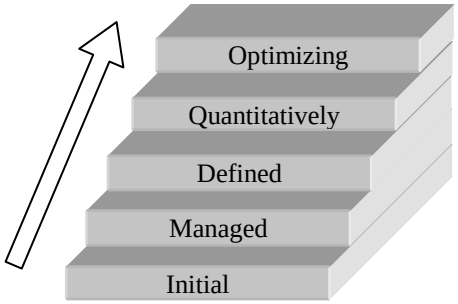
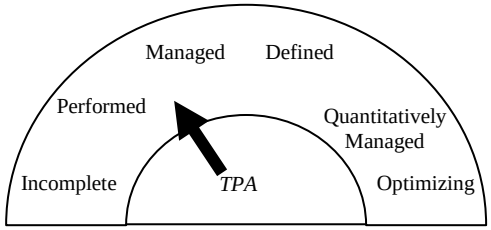
Maturity Level (ML)	Capability Level (CL)
	
1. *Initial* : teaching is chaotic in order to complete a course	**0. *Incomplete***: cannot satisfy all the specific goals (SG) in a teaching process area (TPA).
2. *Managed*—*basic course-management*. At this stage, course management related teaching processes areas are managed and controlled. Similar courses would have a similar teaching performance.	**1. *Performed***: satisfy all the SGs in a TPA **2. *Managed***: the performance of conducting a teaching process area is similar in similar courses
3. *Defined*— *defining & improving course development*. At this stage, teacher teaching processes are defined and are able to be tailored. Teaching improvement practice begins to establish and sustain.	**3. *Defined***: a teaching process area is defined and is able to be tailored. Process improvement is established and standardized for improving the process area.
4. *Quantitatively Managed*—*quantitative teaching and quality management*. At this stage, teacher quantitatively manages all teaching processes by quantitative objectives.	**4. *Quantitatively Managed***: a teaching process area is quantitatively managed based on established quantitative objectives.
5. *Optimizing*—*continually optimizing Teaching quality*. At this stage all teaching process areas are continually improved and sustained at their optimal situation.	**5. *Optimizing***: a teaching process area is continually improved and sustained their optimal situation.

Fig. 1: The teaching maturity and capability levels

3 SCAMPI

SCAMPI, i.e. Standard CMMI appraisal method for process improvement, is designed for software organizations to examine how they have achieved and implemented the process requirements defined in the CMMI for software development (Staples, et al., 2007; Bush, 2005). SCAMPI is a decision support approach with an organizational appraisal scope to help determine the CL/ML level of a software organization and identify its strengths and weaknesses in software development (Ali and Ibrahim, 2011; Wilkie, et al., 2005). In addition to the accomplishment of a CL/ML, organizations regard the findings as the next goal for reaching superior quality of software development.

In SCAMPI, appraisers are provided with actual projects that are conducted by the appraised organization as the evidences of process implementation. Evidences are the artifacts such as the data and documents produced in the appraised projects and relevant to the focused processes, and the interviews with relevant stakeholders to help confirm the execution of the processes. The procedure of SCAMPI, according to SEI (2006), comprises of three stages: planning and preparing for appraisal, conducting appraisal and reporting results. The preparation stage consists of five steps: determine the appraisal scope, develop an appraisal plan, prepare an appraisal team, obtain the evidences and prepare for appraisal conduct, i.e. the readiness review prior to the appraisal. The appraisal stage includes six steps: prepare participants, examine the evidences, document objective evidences, verify the evidence, validate preliminary findings and generate appraisal results. The reporting stage includes 2 parts: deliver appraisal results and package and archive appraisal assets.

In the evaluation of process implementation of specific practices, SCAMPI characterizes it into four levels, i.e., fully implemented (FI), largely implemented (LI), partially implemented (PI), and not implemented (NI) (SEI, 2006, p.97). A specific or generic goal is rated Satisfied if and only if both of the following are true: (1) all associated practices are characterized at the organizational unit level as either LI or FI, and (2) the aggregation of weaknesses associated with

the goal does not have a significant negative impact on goal achievement (SEI, 2006, p.158). In the case of capability rating, a CL is determined when the required generic goals are satisfied. For example, a process area has achieved CL-2when the generic goal that characterizes this level is satisfied. In the case of maturity rating, a ML is determined when its aggregated process areas have reached the same level of CL. For example, an organization has achieved ML-2 if all of the process areas constellated in this maturity level have achieved CL-2.

4 The Draft Framework

4.1. Applicability review

In this section, the idea and features of the assessment framework is presented. Because the assessment framework conditionally applies the concepts of SCAMPI, this paper reviews the applicability. The review centers on comparing the two assessment methods in four aspects: appraisal scope, verifying focus, operating environment, and appraisal effort and cost.

The first applicability issue refers to the differences in appraisal scope. Because software development is teamwork with a goal to preserve knowledge in organization, SCAMPI has an organizational appraisal scope and the process is more complicated and involves substantial documentation (Yucalar and Erdogan, 2009; Wu et al., 2006). In higher education, since university teachers are independent and the improvement of TQ is based on individual needs, the assessment framework has an individualized assessment scope. Hence, in applying the process of SCAMPI, the assessment framework requires tailoring to have a simpler process and reduced documentation workload due to its individualized scope.

The second applicability issue refers to the verifying focus. To fully realize how an organization does in meeting the process requirements defined in CMMI, SCAMPI examines the organization's projects, since they provide evidences of comprehensively covering the software development processes. To the TQ assessment in higher education, the assessment framework evaluates a teacher's TQ by examining the courses that are taught by the teacher. This is because that course data actually reflects the teacher's teaching methods and can demonstrate the teacher's actual implementation of the requirements defined in T-CMM.

The third issue pertains to the operating environment of appraisal. To SCAMPI, the operation is centralized; it is often carried out on location of the assessed organization for the accessibility of people and data. Such a centralized operation is reasonable, since SCAMPI has an organizational scope and most of the participants are from the assessed organization. To the assessment framework, because of the teaching independence, course data are often controlled and maintained by teachers, making the TQ assessments less possible to be centralized, i.e. collecting teachers for the assessment. The assessment should be design to resolve this particular situation.

The fourth applicability issue is appraisal effort and cost. Due to the aforementioned organizational scale and assessment scope, SCAMPI is conducted in team and the capability/ maturity rating is a group decision. SCAMPI also often involves considerable costs, due to the scale of the assessment scope, the requirement of the operating environment and the scale of appraisal team. To the assessment framework that has an individualized scope, it may not require a team to conduct a teacher's TQ assessment, as well as for reducing the assessment cost. Nevertheless, the rating may be arbitrary or subjective if the assessment has less or no team support.

4.2. Process framework

Fig.1 is the process framework of the assessment framework. As the figure shows, a TQ assessment comprises two stages: preparation (P) and assessment & reporting (AR). Because the assessment service is designed to be requested on demand, the assessment framework is instantiated and enters the preparation stage when a teacher submits an assessment application. During the initialization, the teacher is required to plan the coverage of the assessment in terms of a particular TML or a particular TCL on certain TPA(s). Because T-CMM imposes a gradual and contextual approach of TQ improvement, the coverage is based on prior assessment results. Therefore, as Fig.2 shows, the assessment framework provides previous assessment (if any) information, for the current assessment to be planned on a contextual and accumulative basis.

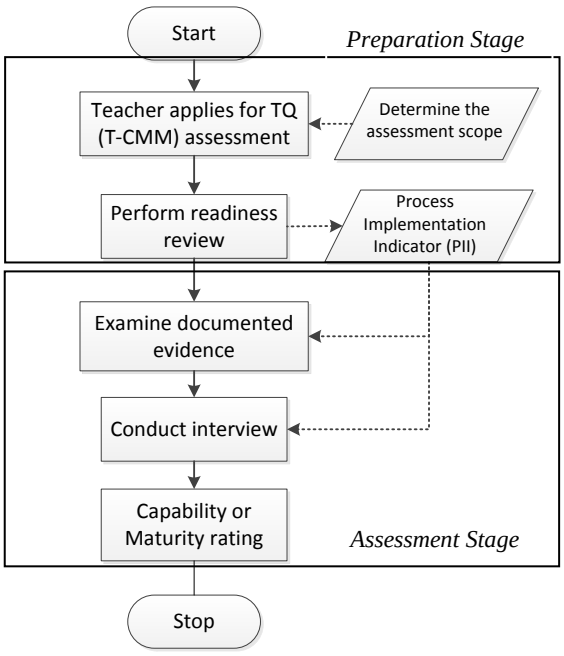


Fig.2: The process framework of the TQ assessment

Also, as the figure illustrates, P consists of a step that collects the data for this assessment based on the coverage. By basing on T-CMM, the data to be collected refer to the evidences that are provided by the teacher to show his/her implementation towards the specific and generic practices (SP/GP) for the to-be-assessed TPAs (see Table 1). Besides, the assessment framework rates TCL or TML based on the teacher's real course cases, hence the evidences refer to the actual data and documents produced in the course. The data also include the name list of course participants, i.e. students, teaching assistants, invited speakers (if any), for the purpose of selecting and inviting them to the interview in the AR stage. Moreover, the assessment framework provides a Process Implementation Indicator (PII), a spreadsheet (e.g. MS EXCEL) for the teacher to upload the evidences and files. As illustrated in Fig.2, the PII provides a summary view for the teacher to check for readiness before entering the AR stage, as well as for the appraiser to access the evidences easily during the assessment.

After the preparation is complete, the assessment framework enters the AR stage to perform the assessment. In this stage, an appraiser is designated for the assessment. The selection of appraisers may affect the quality of the assessment, thus it will be further addressed later in discussing the practical issues of the proposed work. The technical part in this stage refers to the TCL/TML rating, which consists of (1) the evaluation of degree of process implementation against the SGs/SPs and GGs/GPs of TPAs defined in T-CMM, and (2) summarizing the overall findings to obtain the resulting TCL/TML level. Once TCL/TML is obtained, the assessment framework performs peer review to ensure the quality of the appraisal results.

5 Discussion

In this section, the process design of the assessment framework is discussed. The discussion is expected to gather valuable comments and opinions via this conference venue, for the future development and usage of the assessment framework.

- *The tailoring of the SCAMPI process*

In spite of the different in assessment scope, both SCAMPI and the assessment framework have the same focus on, that is, process examination. With the same emphasis, the assessment framework applies and tailors SCAMPI for the educational domain and individualized use of TQ assessments. In reviewing such a tailoring, this study follows the leveled approach, i.e. lifecycle, procedure, role, and work-products (Chen and Huang, 2009; Fitzgerald et al., 2003). First, for the tailoring of assessment lifecycle, the number of stages in SCAMPI is reduced to 2 in the assessment framework. Second, for the process level of tailoring, the steps P1, P2, P3 are integrated into one step, i.e. applying TQ assessment, in the assessment framework; the steps. For the role tailoring, the proposed work preserves the appraiser and role, thus the procedures performed by the appraiser are preserved in the proposed process design. For the work-product level, the proposed work simplifies the artifacts of appraisal plans, appraisal reports and PIIs by incorporating them into the system for an online production of the work products to support the reduced scale and scope of TQ assessments.

- *Assessment on-demand and reducing the assessment workload*

Owing to the characteristics of individualization and dispersedness of participants, the assessment should be requested on-demand. That is, a teacher should be able to individually request for an assessment to certify different TML/TCL levels. Besides, care must be taken in reducing the workload for such an individualized assessment. For a TQ assessment to be able to request on demand, the assessment framework is expected to be associated with Information System and Quality (ISQ) Laboratory that would launch an experimental administrative program, including applying for TML-TCL assessment, recruitment of appraisers and appraisal data maintenance. The assessments would be available shortly when the experiment is set. However, due to a research prototype, the assessment is expected to be available only in Taiwan area.

To reduce the workload in preparing and performing such an assessment, information technologies may be considered as a solution. In this regard, the proposed framework and the process design will be further implemented into an online assessment system in the next stage of the research. The computerized functions are supposed to facilitate the tedious execution of the appraisal service and to help manage effectively the tremendous volume of assessment data. The computerized implementation should be able to offer the convenience for a teacher to upload the evidences, as well as for the appraiser to view the contents by clicking on the links. Moreover, online messaging or live talk functions should be provided with participants for operating a more flexible interview in such a TQ assessment.

6 What is Next ?

In schools, teaching quality has been playing a major role in the success of education. As existing research of educational quality mostly focuses on organizational benefits, the proposed work in this paper is designed to accredit teaching individuals and teachers. The design of the teaching capability and maturity assessment provides an

individualized and quantifiable roadmap to help teachers improve teaching quality.

In the next stage of research, we are to further cooperate with an educational research laboratory (i.e. ISQ) for developing the assessment framework. In addition, we are to develop an online assessment system, for the assessments to be more flexible and effective. Third, we are to apply some information technologies, to help address the subjectivity of manual justification when determining the levels of process implementation in TQ assessments. The development of the work and the promotion to the society has been with an ultimate shared goal: towards superior education quality.

Acknowledgement

We would like to thank Taiwan's National Science Council for granting and financially supporting this research (2013-2014)[No: 102-2221-E-008 -054].

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