The Development and Validation of a Framework for Teaching Competencies in Pedagogy Content Knowledge and Instructional Quality

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One of the vital aspects of a university is its quality teaching. Quality teaching in higher education matters for student learning outcomes. As generally understood, the academia factor plays the most important role in making the mission of improving teaching and learning quality a success. In this regard, the intellectual community in universities must equip themselves with the necessary knowledge and skills to enhance teaching success, in turn, positive student outcomes. Having adequate pedagogy content knowledge and good instructional quality are essential for effective learning thus inevitable and critical competencies required for teachers. In general, this study it aims to develop and validate a framework of teaching and learning competencies among lecturers of UTeM specifically in classroom management and climate. The constructed framework for teaching and learning comprises of the following components: Pedagogical Content Knowledge, Instructional Quality, Classroom Management, Climate, Mindset and Values, IT Competencies, and Technical Competencies. This paper however, reports only two components i.e. Classroom Management and Climate. A confirmatory factor analysis was utilised to assess the adequacy of the two components in the proposed framework. This study may be instrumental to guide the university's top management particularly the academic managers of the university to plan and conduct the intervention programmes to further enhance the quality of teaching and learning of the university.

Keywords: Teaching and learning, pedagogy content knowledge, instructional quality, teaching competence

1.0 Introduction

In the face of ever increasing pressures on the quality and credibility of higher education, the academicians are required to continuously develop themselves professionally notably their teaching competencies. Considerable researches attempt to investigate what teaching competencies are required in modern, more student-centred higher education teaching contexts nowadays. Tigelaar *et.al* (2004) defined teaching competencies as an integrated set of personal characteristics, knowledge, skills and attitudes that are needed for effective performance in various teaching contexts. A framework of teaching competencies adjusted to current landscape of higher education can be instrumental as a starting point for evaluation purposes and for teachers to set professional learning goals.

Brok and Van Tartwijk (2006) highlights among the teaching competence required nowadys are the creation of positive teacher-student relations, managing and monitoring student behaviour, and teaching for student attention and engagement. Nowadays teachers do not only impart information and knowldge but must also competent in managing the physical as well as the psychosocial aspects of the classrooms. This is due to the fact that the overall learning

environments, atmosphere, ambience, tone, and ethos have significant influence on students' satisfaction and performance. According to Smith and Simpson (1995), effective teachers for higher education must not only possess scholastic skills but also planning, management, communication, evaluation as well as interpersonal skills. The management skills are highly required to manage the learning environment that could result to optimum learning. Communication skills are indeed desirable to promote students engagement, enhance motivation, build confidence and collaboration among students, which in turn enhance the successful attainment of the goals of the course.

Numerous attempts have been made to define teaching competencies and to identify its components as well as the characteristics of effective university teaching by using a variety of theoretical perspectives, from qualitative and quantitative approaches, and from various discipline. Common components for teaching competencies in most frameworks are: competencies in content knowledge, instructional qualities, and classroom management. Yet, there is a lack information and studies conducted among engineering and technical educators.

The development of pedagogical content knowledge and good instructional quality in developing professional teaching capacity have been identified as key elements for scaling up educational improvement across instructional programs (Fink & Resnick, 2001). Because students across a broad spectrum of background knowledge and interests are being asked to learn more challenging content at deeper levels than ever before, it follows that the demands on educators to learn how to teach students to high levels are more challenging than ever before. Therefore, there is a need to identify engineering and technical educators' competencies, especially in terms of their pedagogy content knowledge and instructional quality in enhancing better teaching and learning process.

1.1   *Pedagogical Content Knowledge*

Cochran (1991) defined pedagogical content knowledge as teachers' interpretations and transformations of subject-matter knowledge in the context of facilitating student learning. The concept of pedagogical content knowledge is not new. The term gained renewed emphasis with Shulman (1986), a teacher education researcher who was interested in expanding and improving knowledge on teaching and teacher preparation that, in his view, ignored questions dealing with the content of the lessons taught. He argued that developing general pedagogical skills was insufficient for preparing content teachers as was education that stressed only content knowledge. In his view, the key to distinguishing the knowledge base of teaching rested at the intersection of content and pedagogy (Shulman, 1986).

Shulman defined pedagogical content knowledge as teachers' interpretations and transformations of subject-matter knowledge in the context of facilitating student learning. He further proposed several key elements of pedagogical content knowledge: (1) knowledge of representations of subject matter (content knowledge); (2) understanding of students' conceptions of the subject and the learning and teaching implications that were associated with the specific subject matter; and (3) general pedagogical knowledge (or teaching strategies). To complete what he called the knowledge base for teaching, he included other elements: (4) curriculum knowledge; (5) knowledge of educational contexts; and (6) knowledge of the purposes of education (Shulman, 1987). To this conception of pedagogical content knowledge, others have contributed valuable insights on the importance and relevance of the linguistic and cultural characteristics of a diverse student population. While other education scholars since the 1990s have expanded and promoted the development of PCK among content teachers through both teacher preparation (pre-service) and professional development (inservice), "valid" research failed to address the issue of linguistically and culturally different students as a mediating variable that should be factored into any study of

effective teaching practices. However, proponents of the PCK concept say that there is special value in their work in that it has served to re-focus educators' attention on the important role of subject matter in educational practice and away from the more generic approach to teacher education that dominated the field since the 1970s (Gess-Newsome & Lederman, 2001).

1.2   Instructional Quality

Meanwhile, instructional quality that is based primarily on classroom observations and student assignments—has strong potential to support professional development within schools or universities at multiple levels (Crosson, 2006).

According to Shulman (1987) a good educator should be able to deliver his/her lesson well or in another words a good educator should be interesting, approachable, presents their material well, makes subject interesting, helpful, and knowledgeable. In 1988, Kenneth Feldman did a meta-analysis of 31 studies in which teachers and students identified characteristics they associated with good teaching and effective instruction. He found that students emphasized the importance of teachers being interesting, having good elocutionary skills, being available, and helpful. Faculty placed more importance on being intellectually challenging, motivating students, setting high standards, and encouraging self-initiated learning

Thus, in general, this study examines the prevalence of teaching competencies in UTeM particularly in pedagogy content knowledge and instructional quality. In this study, a framework of teaching competencies is proposed with the following components: Pedagogical Content Knowledge, Instructional Quality, Classroom Management, Climate, Mindset and Values, IT Competencies, and Technical Competencies. However, this study focuses merely on the development and validation of this framework of teaching competencies inpedagogy content knowledge and instructional quality,

2.0   Method

This study employed quantitative method of data collection. A total of 230 lecturers of UTeM participated in this study, 120 males and 110 females. The instrument used in the study was a questionnaire consisted of 109 items, 10 items were for the subjects' demography and 99 items were for the perception of lecturers on teaching competencies in UTeM. The items for the perception of lecturers on teaching competencies were using a five point Likert scale (Scale 0 denoting 'Irrelevant', scale 1 denoting 'Strongly Disagree', scale 2 denoting 'Disagree', scale 3 denoting 'Agree', and scale 4 denoting 'Strongly Agree'.

As mentioned earlier, a framework of teaching competencies is proposed with the following components: Pedagogical Content Knowledge, Instructional Quality, Classroom Management, Climate, Mindset and Values, IT Competencies, and Technical Competencies. The components of Mindset and Values and Technical Competencies were added as new components for teaching competencies.

The items for this instrument was validated by a group of experts identified from UTeM, as well as, other public university. Then, we piloted the instruments to 30 samples. Subsequently, the collected data was analysed using SPSS to determine its validity. The final version of the questionnaires consist of 109 items from 154 items.

Sampling was done using stratified random sampling. A total of 480 survey was distributed to academicians but only 230 were returned. Data collected was then analysed using AMOS

programme to confirm the selected items for each component thus to validate the framework. This paper reports the result of confirmatory factor analysis which explicitly validates the framework of classroom management and climate as components of teaching competencies for UTeM academicians.

3.0   Results and Discussion

3.1   *Confirmatory Factor Analysis*

The Confirmatory Factor Analysis (CFA) is the first step conducted prior the SEM analysis (Hair et al., 2010). Here, the CFA was meant to define the individual constructs and was employed for three major purposes, namely to test for (i) model fit, (ii) convergent validity and (iii) construct reliability (Awang, 2013; Loehlin, 2013; Rencher & Christensen, 2012).

For the model fit test, two criteria were being considered; the fit indices and the individual factor loadings of each item in a construct. As shown in Table 1 is the set of criteria for fit indices and their recommended value.

Table 1: Fit indices and recommended value for CFA

Fit Indices	Recommended value
CMIN/DF	≤ 5.0
Relative x^2	≤ 5.0
CFI	$\geq .90$
IFI	$\geq .90$
RMSEA	$\leq .80$
Factor loadings	Between .5 to 1.0
	Positive

According to Rencher and Christensen (2012) and Loehlin (2013), in the model fit test, the standardised factor loadings must be between .5 and 1.0 and should be positive. The indicators that do not meet these criteria shall be deleted. The concentration should be given more to an indicator or item that associated with high Modification Index (MI). Other considerations that need to be considered are referring to the previous literatures on the importance and significance of the items in the questionnaire. If the item(s) is/are to be considered as important, it should be retained in the model (Byrne, 2013).

The next test is the convergent validity test. This test is meant to identify the validity of each item that presumes to measure a construct (Kline, 2011). The convergent validity could be tested using the Average Variance Extracted (AVE). The AVE value which is $\geq .5$ indicates a high convergent validity (Hair et al., 2010).

The final test in the CFA is the construct reliability test (CR). The construct reliability test is a measurement of the internal consistency of the observed indicator or variables. If the construct reliability is $\geq .7$, the item is considered reliable.

It is worth to note that once the three tests were conducted in the CFA, the number of items for each constructs was expected to be reduced and there might be or might be not a model that will be found to be unfit. So, if there was only one model identified unfit, the construct was considered as unreliable and ought to be omitted from the model. However, if there were more than one unfit model, the models should be combined and renamed as a new construct (Loehlin, 2013).

The Analysis of Moment Structure (AMOS) was used to validate the framework of classroom management and climate as components of teaching competencies for UTeM academicians. Table 2 reports number of items in each domain, number of items omitted and the percentage of items omitted in each component.

Table 2. Number of items in each domain, number of items omitted and the percentage of items omitted in each component

Component	Number of items	Number of items deleted
Pedagogy Content Knowledge	8	3
Instructional Technology	10	none

In terms for pedagogy content knowledge (PCK) factor, before CFA, there were 10 items (B1, B2, B3, B4, B5, B6, B7 and B8) in measuring factor. The initial model indicated a poor fit (CFI=.914; IFI= .915; RMSEA=.116). Since the model was considered as unfit, the process of improving the model was conducted by concentrating on the standardised factor loadings and referring to the Modification Index (MI).

Chi-square (df) = 62.216 (20); P value = .000;
Relative Chi-Sq = 3.111; AGFI = \agfi;
GFI = \gfi; CFI = .914; IFI= .915; TLI (>=0.9) = .880;
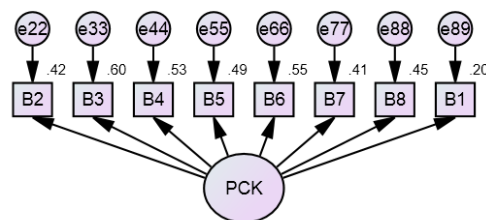RMSEA = .116
(Standardized estimates)

Diagram 1: Pedagogy Content Knowledge before CFA

After CFA, all factor loadings were observed and five items (B1, B2 and B5) were identified to be less than .5, were deleted. This could be due to the characteristics of the items themselves. The items could be too detailed, inappropriate and redundant with other items within the same construct. Then, the test was conducted again and it showed a good fit (CFI=1.000; IFI= 1.004; RMSEA=.000). As a result, the construct met the model fit. The remaining five items (B3, B4, B6, B7 and B8) were found to be the most appropriate items measuring the classroom management as one of the main components for teaching competencies.
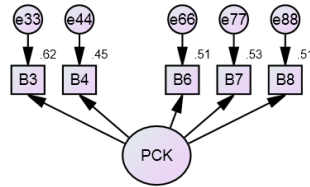
Diagram 2: Pedagogy Content Knowledge after CFA

Meanwhile, in terms of instructional quality factor, there were 7 items (C1, C2, C3, C4, C5, C6 and C7) in measuring the factor. The initial model already indicated a good fit (CFI=.972; IFI= .972; RMSEA=.072). Since the model was considered as fit, the process of improving the model was unneeded.
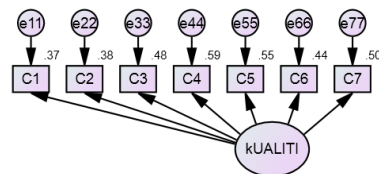
Diagram 3: Instructional Quality

The Analysis of Moment Structure (AMOS) was used to validate the framework of pedagogy content knowledge and instructional quality as components of teaching competencies for UTeM academicians. Table 3 explains in details the deleted as well as the accepted items for both pedagogy content knowledge and instructional quality.

Table 3: Items that were omitted and accepted

Component	Omitted Items	Accepted items
Pedagogy Content knowledge	develop syllabus of related subject and lesson plan [B1]	Create and transfer innovation in teaching and learning [B3]
	conduct reflection and improve teaching and learning process [B2]	Integrate technology utilisation in teaching and learning [B4]
		identify students' ability [B6]
		Conduct new paradigm in instructionaL [B7]

	Compile all the teaching and learning resources systematically [B5]	Utilise various measurement in evaluating students' performance [B8]
Instructional Quality	**None**	Use a simple language [C1]
		Use different type of intonation while delivering content [C2]
		Optimize the students' intention by varying the learning activities [C3]
		Deliver a systematic instructional [C4]
		Ensure that the instruction given to students is aligned with their level [C5]
		Strategize a good evaluation in measuring students' performance [C6]
		Give a clear instruction to students [C7]

4.0 Conclusion

Overall, this study aims to validate the framework of pedagogy content knowledge and instructional quality as components of teaching competencies for UTeM academicians. In general the results indicate that the accepted items are the most appropriate to measure teaching competencies in pedagogy content knowledge and instructional quality. As can be seen in Table 3, a total 3 out of 15 items were omitted. This is because the omitted items were believed to share the same common features in terms of definitions and measure up to the same criteria.

In general the results of the confirmatory factor analysis indicate that the items for teaching competencies from the perspectives of pedagogy content knowledge and instructional quality should be broadly defined. The items that were omitted in classroom management, such as the emphasis on the lecturers' ability to develop related syllabus, conduct reflection as well as compile teaching and learning resources are too detailed, too prescriptive and perhaps very technical. The non-technical factors such as the abilities to create innovation in teaching and learning, integrate technology, identify students' ability and utilise various measurement while evaluating students' performance are deemed necessary for lecturers of higher education.

The results also showed that criteria of using a simple language, utilising different type of intonation while teaching as well as optimizing students' intention by varying learning activities are found to be appropriate for instructional quality. This might be explained by the fact that inward-looking approach in teaching is less appropriate nowadays. This is in line with current teaching approaches for higher learning which focused more on cooperative learning which promotes social interdependence, engagement and active participation during class. In order to keep the students fully engaged in the classroom, teachers must be able to create and maintain positive teacher-student and peers relationship.

To sum up, this study suggests that exemplary university teachers from the perspectives of classroom management and climate must be able to maintain a positive classroom environment specifically to stimulate students' interest, engagement, and motivation in learning, to have positive rapport with students, show high expectations of them, and to continuously foster the value of social interdependence among the students.

As the findings of this study indicated, a new framework of teaching competencies highlights the fact that lecturers should have an adequate knowledge in terms of pedagogy content knowledge

and instructional quality in order to foster the development of effective teacher-student learning activities. Lecturers must also be creative enough to create a respectful, collaborative learning environment to enhance students' positive social behaviour and to stimulate students' proactive participation in the classrooms.

University lecturers may find this framework as instrumental to improve their teaching approaches as to suit students' perspectives, goals and strategies. The academic and human resource development managers in universities may find this framework as beneficial in planning, developing and managing the appropriate intervention programmes for the academic staffs to become high performing university teachers for the betterment of the universities.

5.0   Acknowledgement

6.0   References

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