Faculty Performance Model Using Structural Equation Modelling (SEM)

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Abstract— Faculty members play an indispensable role in the enhancement and sustainability of academic excellence in higher education institutions inasmuch as they are the individuals responsible for implementing the tasks that are directly associated with the goals. The Faculty Performance Evaluation System (FPES) in Don Mariano Marcos Memorial State University (DMMMSU) is a systematic approach towards the evaluation of faculty performance in various job-related functions namely: instruction, involvement in research activities, and rendition of expert services. A synthesized harmonization of these three components is, for this reason, an essential component in the university's drive to achieve academic excellence. The study explored the relationships between pairs of the three components considered for the DMMMSU faculty performance evaluation system. Moreover, the conducted research generated two conceptual models that depicted the relationships among the variables surrounding faculty performance. Significant relationship exists between teaching effectiveness and expert services rendition. However, there is no significant relationship between involvement in research activities and expert services rendition, and involvement in research activities and teaching effectiveness.

Index Terms— performance model, structural equation modelling (SEM), teaching effectiveness, research activities, expert services

I. INTRODUCTION

In order to achieve an effective educational reform, faculty development emerged as a key factor. In general, faculty development facilitates the professional, personal, organizational, and instructional growth of faculty and faculty members. It promotes improvement in the academy primarily through helping individuals evolve, unfold, mature, grow, cultivate, produce, and otherwise develop themselves as individuals and as contributors to the academy's mission (Watson & Grossman, 1994).

Suffice it to say that the primary goals of higher education institutions are enhancing and maintaining academic excellence. Consequently, faculty members stand as the forerunners for achieving these goals since they are the ones responsible for implementing the tasks that are directly associated with these goals. Notwithstanding this crucial role of faculty members, higher education institutions need to ensure their effectiveness through the provision of relevant faculty development programs to enhance their skills and enable them to work more effectively (Prachyapruit, 2001). Faculty development, thus, play a significant role in increasing the quality of a faculty environment, particularly by emphasizing academicians' roles as instructors.

A key factor in evolving an effective and functional faculty development program is benchmark knowledge on the present status of faculty performance along identified domains.

Identification of said status inevitably necessitates the conduct of faculty performance evaluation. Faculty evaluation processes foster the building of relationships based on trust, mutual commitment, and team effort. Intellectual honesty, rigor, and fairness are essential throughout the process.

The Faculty Evaluation System (2012) of Wharton County Junior College outlines the purposes of faculty evaluation as a means to: 1. Assess and promote excellence in the teaching/learning process; 2. Meet the educational needs of students and community by continually monitoring instructional performance; 3. Provide a constructive framework for evaluating faculty performance by identifying areas of strength and areas for improvement in classroom instruction; and 4. Provide a basis for professional growth and development.

Since the early 1970s, there had been a considerable number of literatures pertaining to faculty evaluation. Centra (1993) published *Reflective Faculty Evaluation: Enhancing Teaching and Determining Faculty Effectiveness*, which was an extensive updating of his *Determining Faculty Effectiveness* (Centra, 1979). Another book entitled *Assessing Faculty Work: Enhancing Individual and Institutional Performance* was published by Braskamp and Ory (1994) as a significant expansion of their earlier book, *Evaluating Teaching Effectiveness* (Braskamp, Brandenburg, & Ory, 1984) that only dealt with evaluating teaching.

The contributions of Miller and Seldin to the literature also require mention. Miller's (1987) *Evaluating Faculty for Promotion and Tenure* was an offshoot of his two other books written in the early 1970s, *Evaluating Faculty Performance* (1972) *and Developing Programs for Faculty Evaluation* (1974). Seldin's (1980) *Successful Faculty Evaluation Programs* was followed by *Changing Practices in Faculty Evaluation* (1984) and *Evaluating and Developing Administrative Performance* (1988). Each of these books cites many other books and articles on faculty evaluation.

This overkill of citations is intended to emphasize that these authors, of diverse specializations and social backgrounds, exhibit a high degree of agreement regarding the general principles that should guide effective faculty evaluation. Cashin (1996) noted the rhetoric common in the higher education stating that the primary purpose of faculty evaluation is to help faculty improve their performance. He argues, however, that an examination of the systems – as used – indicates that the primary purpose is almost always to make personnel decisions. In other words, faculty evaluations are used as basis to make decisions for retention, promotion, tenure, and salary increases (summative evaluation). Summative evaluation is both legitimate and necessary, and can serve to improve the institution. However, it does not necessarily help the individual faculty member improve (formative evaluation or development).

Whether the purpose of faculty evaluation is summative or formative rests upon the discretion of the college or university concerned. Regardless, the fact remains that evaluating faculty performance is an indispensable process in enhancing the quality of a faculty environment through an effective and functional faculty development.

In the Philippines, among the mechanisms of ensuring and maintaining the quality of instruction offered by HEIs is undergoing accreditation. A vital area of concern in every accreditation endeavor is the area of *Faculty*. In this area, faculty members are assessed in terms of academic qualification, expert services rendered, research undertakings, and instructional performance, the latter being predominantly determined by looking into the faculty's performance evaluation.

Insistent of the fact that assessing the teaching performance of teachers is a primary concern among educational institutions to gauge the quality of instruction represented by an institution and facilitate better learning among students, Magno (2009) conducted a metaevaluation of a teacher performance system used in the Performance Assessment Services Unit (PASU) of De La Salle-College of Saint Benilde in Manila Philippines. To determine whether the evaluation system on teacher performance adheres to quality evaluation, the standards of feasibility, utility, propriety, and accuracy are used as standards. Magno's results showed that most of the stakeholders were satisfied with the conduct of teacher performance assessment. Although in using the standards by the Joint Committee on evaluation, the results are very low. The ratings of utility, propriety, and feasibility were fair and the standard on accuracy is poor.

Seeing the Need for an Objective Teacher Evaluation, Alicias (2005) conducted a study utilizing the variance partitioning analysis (VPA) model which sought to partition the total variance of the dependent variable (post-test student achievement) into various portions representing: first, the effects attributable to the set of teacher factors; second, effects attributable to the set of control variables the most important of which are IQ of the student, his pretest score on that particular dependent variable, and some measures of his socio-economic status; and third, the unexplained effects/variance. He found out that when the second and third quanta of variance are partitioned out of the total variance of the dependent variable, what remains is that attributable to the teacher.

Alicias' (2005) choice of VPA model arose from the notion that teacher performance evaluation is usually done using ratings made by students, peers, and principals or supervisors, and at times, self-ratings made by the teachers themselves. Citing Glass and Martinez, Alicias (2005) argued against: the obvious subjectivity of this practice; its vulnerability to the so-called "politics of teacher evaluation"; and the professional incapacities of the raters.

In an attempt towards objective and evidenced-based evaluation, the value-added analysis (VAA) model presents itself as a plausible alternative. However, it appears flawed primarily because it posits the untenable assumption that the gain score of students (value added) is attributable only and only to the teacher(s), ignoring other significant indicators of student achievement like IQ and socio-economic status. Further, the use of the gain score (value-added) as a dependent variable appears hobbled with the validity threat called "statistical regression," as well as the problem of isolating the conflated effects of two or more teachers (Ibid.).

Needless to say, the conduct of faculty evaluation comes in various forms. Generally, they may be summative or formative. summative evaluation typically utilizes checklist-type forms that provide little room for narrative, and take note of observable traits and methods that serve as criteria for continued employment, promotions, and the like (Isaacs, 2003). Formative evaluations, on the other hand, are geared toward professional development. In this form of evaluation, teachers and their administrators meet to try to trace the teacher‘s further development as a professional (Bradshaw, 1996).

Working from the premises that teaching is a profession where teachers should have a certain level of control over their development as professionals, a flexible model of evaluation called differentiated supervision has been established to allow for a clinical model of evaluation, a cooperative options that allow teachers to work with peers, and a self-directed options guided by the individual teacher‖ (Glatthorn, 1997; Isaacs, 2003). The three processes in the Differentiated Supervision Model are: (1) Focused Supervision, (2) Clinical Supervision, and (3) Self-Directed Supervision. In this model, the professional staff and supervisors/administrators have options in the process applied for supervision and evaluation. The supervision program is designed to be developmentally appropriate to meet the needs of each member of the professional team.

The collaborative evaluation method follows a mentor/administrator-teacher collaboration scheme where a teacher, whether new or experienced, is aided by a mentor (Berliner, 1982). This model requires a more intensive administrative involvement that may include multiple observations – such as journal writing or artifact collections – plus a strong mentoring program‖ (Isaacs, 2003). At the end of a prescribed period, the mentor and mentee sit down to compare notes on the data gathered over the observation period and identify strengths, weaknesses, areas for improvement, and other such points. In this model, there are no ratings, no evaluative commentaries and no summative write-ups (Isaacs, 2003).

The multiple-evaluation checklist, on the other hand, uses several instruments other than administrator observations. The peer evaluation, the self-evaluation, and the student evaluation are triangulated to form a teacher‘s evaluation (Isaacs, 2003). Self-evaluation also plays an important role in the evaluation process. It is also said to promote a sense of responsibility and the development of higher standards (Lengeling, 1996).

The most commonly-used evaluation is the student evaluation (Bonfadini, 1998; Lengeling, 1996; Strobbe, 1993; Williams & Ceci, 1997). They are the easiest to administer and they provide a lot of insights about rapport-building skills, teacher communication, and effectiveness. However, it has been found that a change in a content-free variable in teaching was enough to cause a great magnitude of increase in teacher ratings (Williams and Ceci, 1997; Isaacs, 2003). For this reason, student evaluations must be viewed with caution. In a similar sphere, Bonfadini (1998), found that when students are asked to rate their teachers according to four determinant areas, (a) personal traits, (b) professional competence, (c) student-teacher relationships, and (d) classroom management, the least rated determinant was professional competence. This is to say that students may tend to look more at the packaging (content-free variables) rather than that which empirically makes a good teacher. Hence, viewing student-based information should be done with care (Isaacs, 2003).

Moreover, the growing use of the portfolio in the field of teacher evaluation is slowly softening edges of the standardized instrument (Engelson, 1994; Glatthorn, 1997; Shulman, 1988; Seldin, 1991). National standards are also used as method for teacher evaluation. It is based on the instigation of a screening board other than the standard licensure committee. This is the counterpart of the Philippines’ National Competency-Based Teacher Standards (NCBTS) which provides a single framework that defines effective teaching in all aspects of a teacher’s professional life and in all phases of teacher development (DepED, 2006). This single framework minimizes confusion about what effective teaching is, and provides a better guide for all teacher development programs and projects from the school level up to the national level (Ibid.).

The NCBTS renders itself as reference for: teacher education institutions to design and implement effective pre-service teacher education curricula; the PRC in designing the Licensure Exam for Teachers; organizations and agencies that implement in-service education for teachers (INSET) in developing their interventions; award-giving bodies in defining their criteria for outstanding teachers; the DepED in formulating its hiring, promotion, supervision, and other policies related to the teaching profession. It shall also use the NCBTS to guide its INSET programs for teachers; and virtually anyone who is interested in improving teaching practices (Ibid.).

Being a state-funded HEI with the capacity of establishing its own policies and guidelines in carrying out its mandate, Don Mariano Marcos Memorial State University (DMMMSU) has evolved its own Faculty Performance Evaluation System (FPES) as a systematic approach towards the evaluation of faculty performance in various job-related functions namely: instruction, research activities, and expert services.

Notwithstanding the importance of harmonizing these three components in order for the university to achieve its desired academic excellence, this research endeavored explored the factors which have strong influence on faculty performance of DMMMSU and determined a model to explain these factors.

II. OBJECTIVES

This study determined a model for the faculty performance of DMMSU using Structural Equation Modeling(SEM).

Specifically, this study sought answers to the following questions:

1. What is the level of performance of the faculty members of DMMMSU?
2. Are there significant relationships between a. faculty performance (in teaching) and research activities ; b. faculty performance and expert services? c. research activities and expert services rendered ?
3. What model could be proposed to explain the factors that are influential on the faculty members’ performance?

Based on the foregoing objectives, the following hypotheses were tested at a significant level of 0.05.

H1. There exists a significant direct relationship between teaching effectiveness and involvement in research activities.

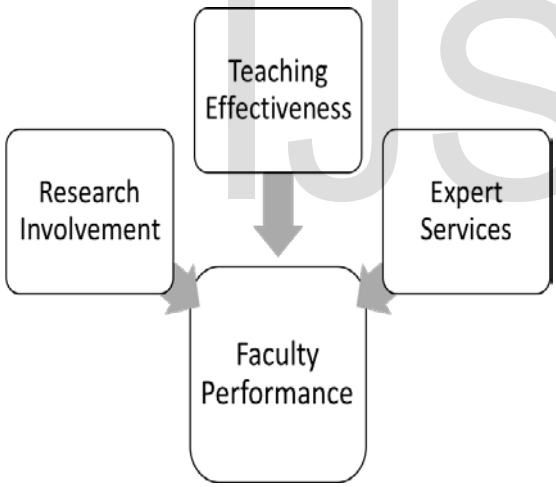
H2. There exists a significant direct relationship between teaching effectiveness and rendition of expert services.

H3. There exists a significant direct relationship between research activities involvement effectiveness and expert services rendition.

III- METHODOLOGY

This study is designed to be a guide for the inevitable application of faculty development programs in DMMMSU. It dentified the level of performance of the faculty of DMMMSU. This research attempted to articulate the factors which have a strong influence on faculty performance and determined a model to explain these factors.

Based on the researchers' focus on the performance of the faculty, this study identified their performance as the endogenous variable. The three exogenous variables that were used included teaching effectiveness, research involvement, and expert services.



This study made use of structural equation modeling (SEM) technique for the development of the models and the software package AMOS developed by SPSS Inc. is very comprehensive for the development and analysis of SEM.

The Structural Equation Modeling technique takes a confirmatory (hypothesis testing) approach to the analysis of some theory bearing on some phenomenon (Byrne, 2010). Typically, this theory represents causal processes that generate observations on multiple variables. SEM conveys two important aspects of the procedure : i) that the causal processes under study are represented by a series of structural (regression) equations, and ii) that theses structural relationships can be modeled by pictorial representation to enable a cleared conceptualization of the theory under study. The hypothesized model was tested statistically in a simultaneous analysis of the entire system variables to determine the extent to which it is consistent with the data for inferential purposes. If the goodness-of-fit is adequate, the model argues for the plausibility of postulated relations among variables; if it is inadequate, the tenability of such relationship is rejected.

Structural equation models are schematically portrayed using particular configuration of four geometric symbols- a circle (or ellipse), a square (or rectangle), a single-headed arrow, and a double-headed arrow. By convention, circles(or ellipses) represent unobserved latent factors. Squares (or rectangles) represent observed variables, single-headed arrows represent the impact of one variable on another, and the double-headed arrows represent correlations between pairs of variables.

IV - RESULTS AND DISCUSSION

Faculty Performance

Table 1 shows the performance of the faculty for the three components namely teaching effectiveness, research involvement, and expert services.

It can be gleaned in Table 1 that the performance of the faculty is outstanding for teaching effectiveness and expert services with mean ratings equal to 4.75 and 4.81 respectively. Also, data were clustered around the mean with the standard deviation equal to 0.38 and 0.41 correspondingly. The performance for research involvement is very satisfactory with a a mean equal to 3.71. Ratings of faculty members in terms of expert services rendition tend to vary a bit from the mean as shown by the standard deviation of 1.40.

Moreover, the study explored the relationships between pairs of the three components considered for the DMMMSU faculty performance system which are the teaching effectiveness, involvement in research activities and expert services rendition and are displayed in Table 2. Following is a brief description of the variables that are used in the extended conceptual model.

Table 1 Faculty overall performance scores among the evaluation's components

Components	Mean	Standard Deviation	Interpretation
Teaching effectiveness	4.75	0.38	Outstanding
Research involvement	3.71	1.40	Very Satisfactory
Expert services	4.81	0.41	Outstanding

Legend:

1.00 - 1.80	Poor
1.81 - 2.60	Fair

2.61 – 3.40	Satisfactory
3.41-4.20	Very Satisfactory
4.21 – 5.00	Outstanding

Variable name	Description
Expert services	
S1	Thesis advising
S2	Paper Presenter
S3	Accreditor/RQUAT/ISA evaluator
S4	Lecturer/Trainer
S5	Membership in committees
S6	Other Services
Research Activities	
R1	Publication(refereed)
R2	Publication (non-refereed)
R3	Researches completed
R4	Thesis Grant
R5	Book author
Teaching effectiveness	
T1	Commitment
T2	Knowledge of subject matter
T3	Teaching for independent learning
T4	Management of learning

Table 2 Relationships between pairs in the indicators of the three components of faculty performance evaluation

Pairs	Correlation Coefficient	p-value
T2 & T1	0.919	<0.001
T2 & T3	0.987	<0.001
T3 & T4	0.980	<0.001
T1 & T3	0.931	<0.001
T2 & T4	0.976	<0.001
T1 & T4	0.911	<0.001
R1 & R3	0.377	0.004
S6 & S5	0.278	0.020
S3 & S1	0.319	0.017
T1 & R4	-0.102	0.042
T2 & S1	0.041	0.031
T2 & S2	0.047	0.010
R3 & R2	0.381	0.003
R1 & S2	0.329	0.008
R1 & S5	0.337	0.008
R3 & S2	0.329	0.006
R3 & S5	0.256	0.024
S6 & R5	0.338	0.012

	Estimate	S.E.	C.R.	P
air				

Significant at 0.05 level

Significant relationships are noted at 5% level of significance along the following: knowledge of subject matter and commitment, knowledge of subject matter and teaching for independent learning, teaching for independent learning and management of learning, commitment and teaching for independent learning, commitment and management of learning, commitment and management of learning, number of refereed publications and number research completed, other services and membership in committees, number of times served as an expert evaluator and thesis advising, commitment and thesis grants, knowledge of subject matter and thesis advising, knowledge of subject matter and paper presentation, number of completed researches and number of non-refereed publications, number of refereed publications and paper presentations, number of refereed publications and membership in committees, number of completed researches and paper presentations, number of completed researches and membership in committees, and other services and book authorships.

Furthermore, the conducted research generated two conceptual models that depicted the relationships among the variables surrounding faculty performance. Figure 1 investigated the relationships in general among these three component variables. The second model in Figure 2 specified the relationships between the factors that are related to these variables. The variables that were used in the conceptual models can be considered as observed variables. All the variables were regressed as un-standardized estimates and 5% level of significance is observed to establish any inferences.

The Preliminary model gives a brief general information about the nature of the relationships between a pair of components in the DMMMSU FPES. In Figure 1 the proposed relationships between the considered observed variables are conceptualized. The model fit is tested using the Goodness of Fit Index (GFI). GFI takes value between 0-1 where 1 indicates perfect fit. The GFI for this model is 0.89 considered as very good fit. The AMOS output of the analysis is reported in Table 3.

Figure 1. Proposed Preliminary Model

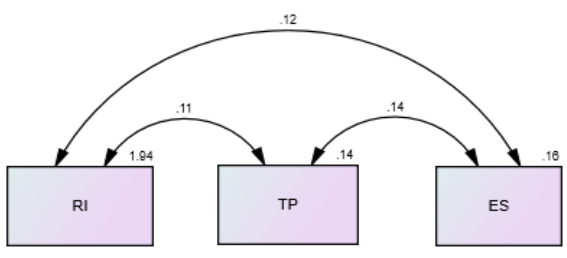
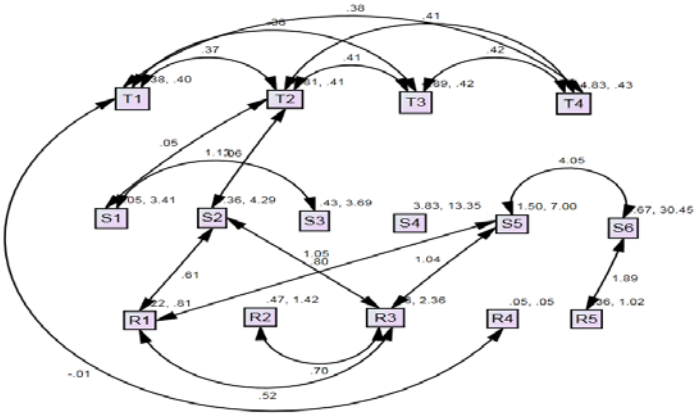


Figure 2 An Extended SEM



Pair	Estimate	S.E.	C.R.	P
Research involvement & Expert Services	0.117	0.076	1.548	0.122
Research involvement & Teaching effectiveness	0.109	0.071	1.531	0.126
Expert services & Teaching Effectiveness	0.142*	.027	5.165	0.000

Table 3 Regression weights of the performance components

Table 3 lists the un-standardized regression weights between the three observed variables namely teaching effectiveness, research activities and expert services. Teaching effectiveness and expert services are positively related at 5% statistical significance. This is due to the fact that the measured regression coefficient between teaching effectiveness and expert services is 0.142($p < 0.05$). However, no statistical significant relationship is evident between research involvement and expert services, and research activities and teaching effectiveness.

Extended SEM

An extended conceptual model investigates more specifically the relationship between teaching effectiveness, research activities, and expert services at DMMMSU FPES by identifying the nature of relationship between the factors that are sued to calculate the total score of these three variables.

Figure 2 presents the relationships between the observed variables of the extended SEM model. It can be noted that specific variables within a component aspect of faculty performance are linked with the other components. Also, specific relationships are shown which further reveals the significant influences between and among specific variables in the performance components.

Further, Table 3 outlines the output of the proposed extended SEM Analysis . It can be seen in the table that significant relationships exist at 5% level of significance. Significant relationships are noted along the following: self and peer evaluation, self and student evaluation , student and supervisor evaluation, peer and student evaluation, self and supervisor evaluation, peers and supervisor evaluation, number of refereed publications and number research completed, other services and membership in committees, number of times served as an expert evaluator and thesis advising, peer evaluation and thesis grants, self evaluation and thesis advising, self evaluation and paper presentations, number of completed researches and number of non-refereed publications, number of refereed publications and paper presentations, number of refereed publications and membership in committees, number of completed researches and paper presentations, number of completed researches and membership in committees, and other services and book authorships.

The foregoing results revealed that high faculty performance is influenced by a lot of factors. Also, the more diverse is the involvement of faculty members in research activities and expert services rendition there tend to be higher teaching performance.

Table 3 Output of Proposed Extended SEM

V- CONCLUSION AND RECOMMENDATION

Conclusion

The faculty members of DMMMSU performed outstandingly on terms of instruction (teaching effectiveness) and expert services rendition. However, they performed very satisfactorily in terms of research activities involvement.

Significant relationship exists between teaching effectiveness and expert services rendition. However, there is no statistically significant relationship between research involvement and expert services, and research involvement and teaching effectiveness.

The faculty performance model highlighted the significance of the sub-parameters along teaching effectiveness, research involvement and expert services rendition as contributory factors in their overall performance.

Recommendations

Considering the results of the study, the University may consider looking into the assignment or loading of faculty members such that involvement in research activities may be increased to help improve their teaching performance. Faculty capability training to include research mentoring, research presentation and publication may enhance involvement in research activities. Moreover, specific indicators that influence faculty performance may be considered in crafting a new performance evaluation system for faculty members in the University.

Pair	Estimate	S.E.	C.R.	P
T2 & T1	.369	.072	5.129	.000
T2 & T3	.409	.077	5.311	.000
T3 & T4	.417	.079	5.284	.000
T1 &T3	.380	.074	5.158	.000
T2 & T4	.408	.077	5.280	.000
T1 & T4	.376	.074	5.098	.000
R1 & R3	.521	.179	2.918	.004
S6 & S5	4.052	1.744	2.323	.020
S3 & S1	1.131	.475	2.381	.017
T1 & R4	-.014	.007	-2.031	.042
T2 & S1	.048	.022	2.163	.031
T2 & S2	.063	.024	2.566	.010
R3 & R2	.698	.232	3.004	.003
R1 & S2	.614	.233	2.633	.008
R1 & S5	.803	.302	2.662	.008
R3 & S2	1.048	.379	2.765	.006
R3 & S5	1.041	.462	2.256	.024
S6 & R5	1.889	.748	2.526	.012

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