

CONFIRMATORY FACTOR ANALYSIS OF NUEVA VIZCAYA STATE UNIVERSITY FACULTY EVALUATION INSTRUMENT

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ABSTRACT

This research on Nueva Vizcaya State University (NVSU) Faculty Evaluation Instrument was conducted ^a to determine if the actual model significantly fit to the existing model, ^b to determine the best model that represents the NVSU Faculty Evaluation and ^c to determine the factor loading in the identified model.

The data were drawn from the NVSU Educational and Testing Center. The raw data of the evaluation from first semester of school year 2014 to first semester of school year 2015 were used. The data were reduced to 507 sample size from 17, 931 populations using the systematic sampling technique. The NVSU has an existing model for the faculty evaluation which is a hierarchical factor model. And there were three hypothesized models of faculty evaluation which are the general, oblique factor and orthogonal factor model.

The researchers used confirmatory factor analysis using Analysis of Moment Structure Software in answering the objectives of this study. The best model among four competing hypothesized factor models is the Oblique Factor Model with an equation below.

$$\text{Total Weight (Oblique Factor Model)} = 22.35 C_1 + 24.975 C_2 + 24.05 C_3 + 27.7 C_4.$$

The factors (Commitment, Knowledge on the Subject of the Teacher, Teaching for Independent Learning and Management of Learning) of the instrument were very strong positively correlated.

AGFI- Adjusted Goodness-of-Fit-Index; AIC- Akaike Information Criterion; CAIC-Consistent AIC; CFI- Comparative Fit Index; ECVI- Expected Cross Validation Index; GFI- Goodness-of-Fit Index; NFI- Normed Fit Index; NNFI- Non-Normed Fit Index; RMSEA- Root Mean Square Error of Approximation; SRMR- Standardized Root Mean Square Residual

INTRODUCTION

Evaluation is the systematic acquisition and assessment of information to provide useful feedback about some objects. The generic goal of most evaluation is to provide “useful feedback” to a variety of audiences including sponsors, donors, client-groups, administrators, staff, and other relevant constituents. The relationship between an evaluation and its impact is not a simple one - studies that seem critical sometimes fail to influence short-term decisions, and studies that initially seem to have no influence can have a played impact when more congenial conditions arise. Despite this, there is broad consensus that the major goal of evaluation should be to influence decision-making or policy formulation through the provision of empirically driven feedback (Govender, 2012).

Evaluation runs a major goal in the field of education especially the teachers. Research shows that teachers are the most important in-school factor in determining a student’s success. Teacher’s evaluations matter why schools hold accountable for conducting accurate evaluations. These will allow teachers who need improvement to be accurately identified so schools can provide the most support to those who need it the most. Consequently, it will help ensure that only the best teachers are in the classroom (Govender, 2012). We must have a good evaluation system to make sure we can help teachers improve.

States, districts and schools all across the United States and other foreign countries are busy developing or implementing teacher evaluation systems. Implementing evaluation system incorporates multiple measures of student achievement as well as student feedback and shall include multiple classroom observations. Using truly valuable evaluation systems will increase a teacher’s professional status (Manzano, 2012).

First assessment was conducted in the Philippines through a survey authorized by the Philippine Legislature (Monroe, 1925). The legislature created the Board Educational Survey, and later, this board appointed an Educational Survey Commission which visited different schools in the Philippines (Magno, 2010). A timeline of events that shaped educational

assessment allows contemporary experts and practitioners to further develop and advance the use of methods, techniques, theory and approaches in the field (Magno and Ouano, 2009).

Some sources of data for evaluating teaching are by self-reflection, colleagues and students. Nueva Vizcaya State University (NVSU) holds faculty evaluation where students are respondents every semester as one of the most influential information in promotion and tenure decision focused on teaching. The use of teacher's self-reflection through the development of teaching dossier is a method that allows individuals to collect and display multiple sources of information regarding their teaching effectiveness for examination by others. It contributes both to sound personnel decisions and to the professional development faculty members. Colleagues who have expertise in the discipline being taught and training in what to observe can provide important evaluative information through classroom visits and review of course materials and instructional contributions. Students were the respondents in faculty evaluation of NVSU for they were able to report on extent to which a teacher appears prepared for class sessions, communicate clearly, stimulate interests, and demonstrates enthusiasm and respect for students; research shows that student responses on these dimensions are valid and reliable.

Teachers in NVSU were evaluated in different aspects. Knowledge of the teachers is evaluated through their mastery on the subject matter being taught. Another is the way they taught the subject through their teaching strategies and does it affects the learners' creativity in enhancing themselves. Classroom management and their commitment on their profession as teachers were also assessed in evaluation process.

The availability of data of faculty evaluation in our own University rooted the researchers to explore this study. Speakers of the seminar held at our university inspired the researchers to look at the different areas of Mathematical Modeling. Faculty Evaluation with the use of Confirmatory Factor Analysis (CFA) through Measurement Model Theory as preliminary study explores the possibility on the application of Mathematical Modeling. Mathematical Modeling is the application of Mathematics which leads researchers to focus on being Mathematics majors. CFA requires the researchers to theorize the underlying structures and assessed whether the observed data fits the priori specified model. In doing so, CFA provides a framework for addressing some of the problems associated with traditional ways of assessing a measure's validity and reliability. The assessment process of studying the data and adjusting the instrument accordingly increased the validity of the importance of the faculty decisions being made with the information. Hence, the conception of this research query was initiated.

Objectives of the Study

This study aimed to answer the following objectives:

1. To determine if the Actual Model significantly fit to the Existing Model?
2. To determine the best model that represents NVSU Faculty Evaluation.
3. To determine the factor loading in the identified model?

Scope and Delimitation

The study was limited to the available data gathered by the NVSU Testing Center in Faculty Evaluation of NVSU, Bayombong Campus during the computerized evaluation system in first semester of school year 2014 to first semester of the school year 2015. The researchers focused on determining the best model that represents the faculty evaluation. This does not focus on its effects to faculty developments and administrator's tenure decision but seeks to determine the factor loading in the identified model and the correlation of the four factors.

Conceptual Framework

NVSU Faculty Evaluation Instrument has an existing model which is practically used for several years in the university. The model is presented in the Figure 1. The instrument used in faculty evaluation has four factors namely commitment, knowledge of subject, teaching for independent learning and management of learning. Each factor has five statements or indicators and rated using 1 to 5. The overall faculty rating per respondent was computed using the following weight per sub categories as follows; 20% in the commitment, 30% in the knowledge of Subject, 20% in the Teaching for independent learning and 30% in the management of learning.

The preceding figure shows the structure of four competing models. These models show the correlation of each factor and the factor loading of each factor to its indicators.

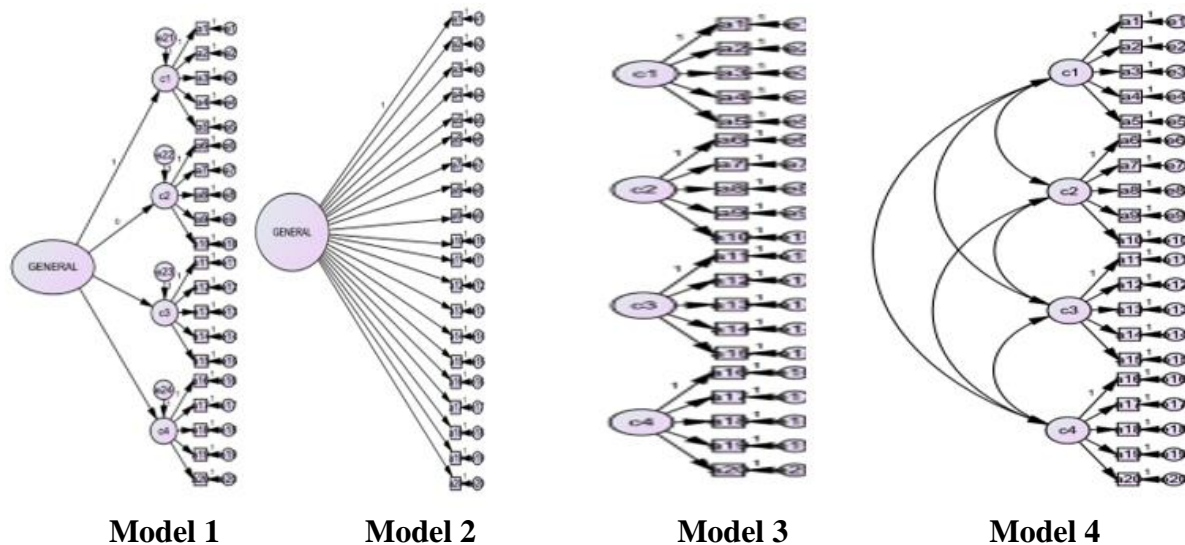


Figure 1. Four competing Factor Models for the Nueva Vizcaya State University Faculty Evaluation Instrument (Refer to Appendix B for description).

Regardless of whether student's evaluation of their instructors to other assessment methods, the objective of this study is to move forward, and contribute to the body of research by designing and validating the scale to enable students to evaluate the competence of their instructors. Faculty evaluation instrument's questions were divided into four factors with twenty indicators that yielded the three models or factor structure of the instrument.

Model 1 – A *Hierarchical Model*: one for the commitment, one for the knowledge of the subject, one for the teaching for independent learning and one for the management of learning.

Model 2 – A *General-Factor* that loads into all twenty questions/ indicators.

Model 3 – An *Orthogonal Factor Model* where the factors are not correlated and the covariance with the factors.

Model 4 – An *Oblique Factor Model* where the indicators are covariance on its factors and the factors are correlated.

While thorough analysis is beyond the scope of this study, it will attempt to answer the problem:

Statement 4: What would be the best model that represents NVSU Faculty Evaluation?

Hypothesis: The data will show that an Oblique Factor Model will have an adequate fit and significantly fit the data better than the other three models.

Research Methodology

The researchers utilized the Confirmatory Factor Analysis (CFA) as the statistical method in making mathematical models with the aid of Analysis of Moment Structure (AMOS) statistical software which was used to specify, estimate, assess and present models to show hypothesized relationships among variables. CFA Procedure was used to evaluate the goodness-of-fit for the four models of the faculty evaluation instrument's indicators/questions. CFA also allows the researchers to cluster these variables in pre-specified, theory-driven ways to evaluate to what extent a particular data set "confirms" what is theoretically believed to be its underlying structure. CFA provides a framework for addressing some of the problems associated with traditional ways of assessing a measure's validity or reliability.

In analyzing the best model, researchers used the Model Fit Indices to check for model fit. The model which does not have a well fit was analyzed further using the Rules of Thumb whether it has a good fit or an acceptable fit. The model has a good fit or an acceptable fit if it satisfies any fit measure in every descriptive measure that was classified as Descriptive Measure of Overall Fit, based on Comparisons, and of Model Parsimony. AMOS software indicates how the factor loads in each indicator and correlation of the factors were computed. Also, this was used to compute for the weight of the factor.

RESULTS AND DISCUSSION

Four Competing Models and the Best Model

The Existing Model of NVSU Faculty Evaluation Instrument is the Hierarchical Factor Model) which has four factors with corresponding weight (20% in the Commitment, 30% in the Knowledge of Subject, 20% in the Teaching for Independent Learning and 30% in the Management of Learning.

Table 1. Factor Loading on the best Oblique Factor Model

	Model 1: Hierchical	Model 2: General	Model 3: Orthogonal	Model 4: Oblique
Chi square	1222.07	549.31	16.18	2.65
df	167	170	170	164
p-value	0.00	0.00	0.00	0.00
CMIN/df	7.32	3.23	16.18	2.66
RMSEA	0.11	0.07	0.17	0.06
NFI	0.85	0.93	0.67	0.95
CFI	0.87	0.95	0.97	0.97
GFI	0.86	0.90	0.66	0.92
AGFI	0.82	0.87	0.58	0.90

The chi square value of the four competing models ranges from 2.65 to 1222.07 with df that is greater than 164 together with the probability value less than 0.001 suggests that the models do not have a well fit. Since the total sample is sufficiently large, it is impossible to get a probability greater than 0.05 (Amora, 2014). Unsatisfying the fit measures above makes the models to not have a well fit which leads the researchers to use the rules of thumb (Muller, et al, 2003) to check if the model has a good fit or an acceptable fit. The model has a good fit or an acceptable fit if it satisfies any fit measure in every descriptive measure that was classified into three which are:

Descriptive Measure of Overall Fit

Descriptive Measure based on Comparisons

Descriptive Measure of Model Parsimony

The Hierchical model has a CMIN/df with a value of 7.318 which is higher than 3, RMSEA with a value of 0.112 which is greater than 0.05 and NFI with a value of 0.851 that is less than 0.95. Also, the model has CFI with a value of 0.859 that is less than 0.90 and AGFI

with a value of 0.822 that is less than 0.85. These fit measures did not satisfy the model fit indices which suggests that the model does not fit.

The General Factor Model has a chi square value of 549.309 with df of 170 together with probability of less than 0.001 suggest that the model does not have a well fit. Researchers used the rules of thumb where CMIN/df with a value of 3.231 is greater than 3, RMSEA with a value of 0.066 that is greater than 0.05 but less than or equal to 0.08, and NFI with a value of 0.933 that is less than 0.95 but greater than 0.90. Also, CFI has a value of 0.953 that is less than 0.95, GFI has a value of 0.897 that is less than 0.90 and AGFI which has a value of 0.873 that is less than 0.90 but greater than 0.85.

The model satisfies the value for RMSEA and NFI which are classified under descriptive measure based on comparison. Also, AGFI was satisfied under the descriptive measure of model parsimony but it does not satisfy any fit measure under descriptive measure of overall fit. This implies that the Model 2 does not fit.

The Orthogonal Factor Model has a chi square value of 16.177 with df of 170 together with probability value of less than 0.001 suggest that the model does not have a well fit. Researchers also used the rules of thumb to check if th model has a good fit or an acceptable fit. The CMIN/df with a value of 16.177 is greater than 3, RMSEA with a value of 0.173 that is greater than 0.08 and NFI has a value of 0.665 that is less than 0.90. Also, CFI has a value of 0.9679 that is less than 0.97 but greater than 0.95, GFI with a value of 0.661 that is less than 0.90 and AGFI with a value of 0.581 that is less than 0.85.

The model satisfies CFI, a fit measure classified under descriptive measure of model parsimony yet it does not satisfies any fit measures under descriptive measure of overall fit and descriptive measure of model parsimony. This implies that the Model 3 does not fit.

The Oblique Factor Model has a chi square of 2.654 with df of 164 together with probability value of less than 0.001 which suggests that the model does not have a well fit. Researchers used the Rules of Thumb to check if it has a good fit or an acceptable fit. The CMIN/df has a value of 2.657 satisfies the Descriptive Measure of Overall Fit with an Acceptable Fit. RMSEA, fit measure under the Descriptive Measure based on Comparisons has a value of 0.057 that satisfies greater than 0.05 but less than or equal to 0.08 that has an Acceptable Fit. Also, NFI has a value of 0.947 with CFI of 0.966 together with GFI of 0.918 and AGFI of 0.895 satisfy to have an Acceptable Fit under the Descriptive Measure of Model Parsimony. Satisfying all of the Descriptive Measures using the Rules of Thumb, the model was classified to have an Acceptable Fit.

The Best Model

Among the four models, employing the Rules of Thumb, only the Oblique Factor Model has classified to have an Acceptable Fit that made it to be the best model that represents the Faculty Evaluation Instrument. Figure below is the Oblique Confirmatory Factor Analysis Model with Standardized Factor Loadings, Covariance and Correlations.

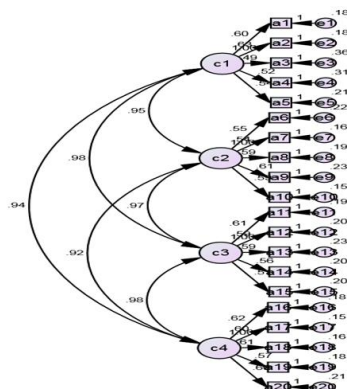


Figure 2. The Best Model

Correlation of Factors for the Best Model (Oblique Factor Model)

Commitment (C1) and Knowledge on the Subject (C2) of the teacher has a very strong positive correlation with a value of 0.95 which means that a committed teacher on his/her profession is knowledgeable on the subject and that if a teacher is knowledgeable on the subject, he/she was committed on his/her profession. While Commitment (C1) and Teaching for Independent Learning (C3) of the teacher has very strong positive correlation with a value of 0.98 which means that if the teacher is committed on his/her profession, he/she is teaching for independent learning and likewise if teacher teaches for independent learning, he/she is committed on her profession. Also, Commitment (C1) and Management on Learning of the teacher has a very strong positive correlation with a value of 0.94. This means that a committed teacher on his/her profession manages the learning very well and if he/she manages the learning process very well, he/she is committed on his/her profession. Knowledge on the Subject (C2) and Teaching for Independent Learning (C3) of the teacher has a very strong positive correlation with a value of 0.97 which means that if a teacher is knowledgeable on the subject, he/she teaches for independent learning and if teacher is teaching for independent learning, he/she is knowledgeable on the subject. Also, the Knowledge on the Subject Matter (C2) and Management on Learning (C4) of the teacher has very strong positive correlation with a value of 0.92 which means that if a teacher is knowledgeable on the subject, he/she manages the learning very well and that if he/she manages the learning very well, he/she is knowledgeable on the subject. Lastly, the Teaching for Independent Learning (C3) and Management on Learning (C4) of the teacher has very strong positive correlation with a value of 0.98. This means that if he/she teaches for independent learning, he/she manages the learning very well and that if he/she also manages the learning very well, he/she teaches for independent learning.

All of the factors for the evaluation instrument are very strong positively correlated. This implies that a teacher is committed on his/her profession if he/she is either knowledgeable on the subject, teaches for independent learning or manages the learning very well. Also, he/she is knowledgeable on the subject if he/she is either committed on his/her profession, teaches for independent learning or manages the learning very well. He/ She teaches for independent learning if he/she is committed on his/her profession, knowledgeable on the subject or manages the learning very well. And teacher manages the learning if he/she is committed on his/her profession, knowledgeable on the subject or teaches for independent learning.

This is supported in the study of Crosswell, et al, (2005) where teachers are investigating beliefs about education and value systems which may include teacher's knowledge on teaching with respect to classroom management and instead of just discussing the way they show their commitment. Teacher's initial commitment and their motivation to enter teaching profession are closely associated according to Day, et al (2006). The study of Liakopoulou (2011) reveals that personality traits and acquired knowledge are determinants of the way a teacher carries out his work. Accordingly, a good teacher should possess a good personality trait, attitudes and beliefs plus pedagogical skills and knowledge. The pedagogical skills and knowledge constitutes the teacher's subject knowledge, teaching methodology, curriculum knowledge, general pedagogical knowledge, knowledge on contexts and knowledge about themselves and it includes knowledge about the learners.

Factor Loading and factor Weight on the Best Model (Oblique Factor Model)

The next table shows the factor loading of Oblique Factor Model on its factors.

Table 2. Factor Loading on the best Oblique Factor Model

	INDICATORS	FACTOR LOADING
A1	“Demonstrates sensitivity to student’s ability to attend and absorb content information”.	0.60
A2	“Integrates sensitivity his/her learning objectives with those of the students in a collaborative process”.	0.63
A3	“Makes self-available to students beyond official time”.	0.49
A4	“Regularly comes to class on time, well-groomed and well prepared to complete assigned responsibilities”.	0.52
A5	“Keeps accurate records of student’s performance and prompt submission of the same”.	0.54
A6	“Demonstrates mastery of the subject matter (explains the subject matter without relying solely on the prescribed textbook)”.	0.55
A7	“Draws and shares information on the state of the art theory and practice in his/her discipline”.	0.54
A8	“Integrates subject to practical circumstances and learning intents/purposes of students”.	0.59
A9	“Explains the relevance of present topics to the previous lesson and relates the subject matter to relevant current issues and/or daily life activities”.	0.61
A10	“Demonstrates up-to-date knowledge and/or awareness on current trends and issues of the subject”.	0.53
A11	“Creates teaching strategies that allow students to practice using concepts they need to understand (interactive discussion)”.	0.61
A12	“Enhances student self-esteem and/or gives due recognition to students’ performance/potentials”.	0.59
A13	“Allows students to create their own course with objectives and realistically defined student professor rules and make them accountable for their performance”.	0.59
A14	“Allows students to think independently and make their own decisions and holding them accountable for their performance based largely on their success in executing decisions”.	0.56
A15	“Encourages students to learn beyond what is required and help/guide the students how to apply the concepts learned”.	0.52
A16	“Creates opportunities for intensive and/or extensive contribution of students in the class activities (e.g. break glass into dyads, triads or buzz/task groups).”.	0.62
A17	Assumes roles as facilitator, resource person, couch, inquisitor, integrator, referee in drawing students to contribute to knowledge and understanding of the concepts at hand”.	0.60
A18	“Designs and implements learning conditions and experience that promotes healthy exchange and/or confrontations”.	0.61
A19	“Structures/re-structures learning and teaching-learning context to enhance attainment of collective learning objectives”.	0.57
A20	“Uses instructional materials (audio/video materials, fieldtrips, film showing, computer aided instruction, etc.) to reinforce learning processes”.	0.60

It can be gleaned from the Table 2 that all indicators have factor loading that ranges from 0.49 to 0.63 which implies that these indicators are closely associated to the factors.

Factor Weight

The best model that represents NVSU Faculty Evaluation is reflected in the equation: Total Weight (Oblique Factor Model) = 22.35 C₁ + 24.975 C₂ + 24.05 C₃ + 27.7 C₄ where C₁ is “Commitment”, C₂ is “Knowledge of Subject”, C₃ is “Teaching for Independent Learning”, and C₄ is “Management of Learning”.

Conclusion

It was found out from the study that the actual model significantly fit to the existing model which is Hierarchical Factor Model. Among the four factor competing models, the Oblique factor model best represents the NVSU Faculty Evaluation Instrument which has an acceptable fit. The factor loadings of the indicators in each factor of the best model ranges from 0.49 to 0.63 which means that the indicators affect each factor, and if the teacher possessed any of the four factors, this means that the other three factors are also possessed by the teacher.

Recommendations

Based on the findings of the study, the following recommendations are made:

¹For the Teachers, to be more committed, knowledgeable on the subject, manage the learning and teach for independent learning will help in their professional development and

skills development. ²For the Director of Educational and Testing Center of NVSU, the best model is the Oblique Factor Model that has a factor weight as follows: 22.35 for “Commitment”; 24.975 for “Knowledge of Subject”; 24.05 for “Teaching for Independent Learning”; and 27.7 for “Management of Learning”. ³For the Administrators, implementation in addressing and improving the teacher’s teaching strategies in teaching learning process. To guide in helping and ensuring the formulation of standards in curricula. Guide in supporting its constituents in promotion and tenure decision. ⁴For the Future Researchers, to make a similar study using other statistical analysis.

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