Association between two events

By

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Declaration

I, hereby ratify that this thesis has solely been framed and comprised by myself and this work has never been submitted elsewhere; partly or fully for the award of any other degree or diploma. I also ensure that all the materials reproduced in this thesis have been properly acknowledged.

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Approval

The thesis titled **"Association between two events "** has been submitted by A.N.M Ashikur Rahman (ID: 2016100000137) of Computer Science & Engineering Department of Southeast University in partial fulfillment of the requirement for the degree of Bachelor in Computer Science & Engineering has been accepted as satisfactory.

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Abstract

In modern education system, teaching evaluation has been regarded as a well-accepted, well-designed and standardized process to rate and assess the effective performance of an educators incorporating the objective of professional development of the teachers as well as quality education for the students. On the other hand, ensuring a just student's grade is also crucial tool to evaluate students' performance accurately. This study offers a structural equation modeling that hypothesizes the directional impact of teaching evaluation on student grade. In this paper, two models are proposed. One has shown directional influence of teaching evaluation on numerical student grade, the other one is on grade frequency. The data used for this research has been collected from website Mendeley Data. The two datasets were generated for two different models. One is consisted of average of student rating, RMP rating of five students and their numerical grades. In other dataset, instead of numerical grades, grade frequency of five students has been taken. The first model has excellent model fit and supported by sample data. It indicates positive influence of teaching evaluation on student grades. The other model has very poor model fit and shows no influence on grade frequency. The model is rejected.

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CHAPTER 1

Introduction

Teaching evaluation has recently been considered as a significant part in almost every university. Students give ratings or evaluate teaching of their respected faculty. Generally, the entire process has been carried out between the mid and the final examination. After the end of the final exam, the teacher gives grades to their students. And the teachers do not get access to the teaching evaluation score before the result has been published. Hence, it can be said that teaching evaluations and students grading are basically two individual events.

However, the teacher who provides scores to the students and the same students gives evaluation scores to the teacher. So, some common factors are visible here. Thus, the question arises "Is there any association between these two events?" And our research objective is to investigate this association. The hypothesis is that teaching evaluation has an influence on grading.

1.2 Choice of Subject & Purpose of the study

Student evaluation scores are a standard component of the way colleges and universities assess the quality of an instructor's teaching for purposes of promotion and tenure, as well as merit raise allocations (Michael A. McPherson, January 2009). In the modern world, it has become part of almost every university. In addition, grading is also important. Here the risk comes for grade inflation which might hamper the standard of assessing students. In addition, proper grading is also important Therefore; it requires an investigation of the association between teaching evaluation and grades.

1.3 Organization of the research

Chapter 2: Early, Similar and Prior and Previous Research and Analysis

It's a prior task for any research or analysis to get to know the earlier activities of similar or near projects. 'Students Evaluation of Teachers' in short SET, it's a very necessary task for the present and future world. Student's grade is also important to evaluate accurately. All these evaluations follow many variables. Different factors work here according to circumstances, such as academic level, gender basic, economic state of a nation, discipline variation, EECE etc. many other departments students, organization students average level, academic environment, expected grade.

In a nutshell if we want to give a glance, then we can come to an initial end that – evaluation process needs many factors. It needs more students of different varieties.

Chapter 3: Methodology

The dataset used in this research is collected from the website Mendeley Data. The new dataset provided in Table 1 (Appendix) for model 1 consists of star rating, RMP rating, grades of students of twenty-nine faculty. For each faculty, the average of star rating, RMP rating of five students and the grades in numeric scale of them has been taken.

For model 2, we modified the dataset given Table1. Instead of taking numerical grades, the frequency of grades of five students has been counted and stored in a dataset. The dataset is given in Table 2 in appendix.

At the beginning a hypothesized model was made (Figure 1, appendix) to demonstrate the relationship between constructs. Then, confirmatory factor analysis was conducted for the measurement model. And finally, SEM (structural equation model) has been used to test the hypothesized model with empirical data. (Dodeen).

Chapter 4: Analysis and results

Model 1:

In this model teaching evaluation is an exogenous variable and grades is an endogenous variable.

Teaching evaluation is reflected by the indicators student rating and RMP rating.
Grades are reflected by the indicators S1_grade, S2 _grade, S3_grade, S4_grade, S5_grade.

The validity table, reliability table, P value, KMO and bartlett's test, model fit indices standardize regression weight are given in the appendix.

Model 2:

In this model teaching evaluation is an exogenous variable and grades frequency is an endogenous variable.

Teaching evaluation is reflected by the indicators student rating and RMP rating.
Grade frequency is reflected by the indicators as AP,A,AM,BP,B.BM ,C,CP ,D,DM,F

The validity table, reliability table, P value, KMO and bartlett's test, model fit indices standardize regression weight are given in the appendix.

Chapter 5: Conclusion and discussion

In this study, two models have been proposed. Model-1 shows the directional relation between teaching evaluation and student grades and model two shows no relation between teaching evaluation and grade frequency. Between these models, model 1 is significant; model 2 is not acceptable due to poor model fit. Researchers can use many dimensions to conduct research on this subject

CHAPTER 2

Early, Similar and Prior and Previous Research and Analysis

It's a prior task for any research or analysis to get to know the earlier activities of similar or near projects. One can also follow; get information from previous tasks, research papers. Here presenting some discussions about the earlier analysis and reports.

2.1 Introductory discussion

'Students Evaluation of Teachers' in short SET, it's a very necessary task for the present and future world. From 1993 this process has become a regular process and this is getting more intense for the upcoming competitive and vast world. As more and more disciplines are occurring, day by day new faculties are opening with very new subjects. Student's grade is also important to evaluate accurately.

All these evaluations follow many variables. Different factors work here according to circumstances, discipline and also human characteristics is one of the prime factors. Same course conducted in different groups of people by same instructor, same course conducted by different instructor, approaching by different evaluation models. Instructor's personality, gender, way of approach, topics they covered, socio economic culture of a society – all these are prime factors in SET.

In more analysis some other factors come out from both student and teacher sides. Like- too friendliness, some bad occurrence during conduction, revenge sense etc. Open-ended question analysis is a very good way to research.

2.2 Data Analysis Discussions

Usually surveys, open ended questions, different level students evaluations, similar courses conducted by different teachers or one teacher conducting different courses- data can be measured in different ways.

Here we put this in graphical format to see the factors outcome. Through these we can come to a decision on how we can approach or what type model should be invented. More extended evaluations can be taken from here. If we want to point out then let's figure a few points:

- Academic different level students. Like- B.Sc., M.Sc., Honors, BBA, MBA different level student discipline and hierarchy.
- Gender basic specification. Both students and teachers.
- Economic state of a nation.
- Discipline variation. Like – a course may have different disciplines. Example- C programming fundamental course has to be done by mechanical, civil, aeronautical, Naval Architecture,
- EECE etc students from other departments. So here all the results, factors and teacher evaluation will not be similar.
- Organization students average level.
- Academic environment. Like- cooperation from other seniors, library facilities, departmental ease environment, campus facilities- these are really big factors.
- Expected grade

2.3 A Summary View

In a nutshell if we want to give a glance, then we can come to an initial end that – evaluation process needs many factors. It needs more students of different varieties. Also vast faculty members. Results can be shown in graphical analysis. Or can be a statistical matrix.

In the USA there are almost 4000 plus universities and degree colleges. They have been working on it since 1970. In this millennium it has become more organized. We can get many views and knowledge from their methods. Their universities are so enriched. In the context of Bangladesh we can work huge as developing countries like Bangladesh. Our responsibility is to build a good nation and future for the next world students.

CHAPTER 3

METHODOLOGY

3.1 Samples

The dataset used in this research is collected from the website Mendeley Data. (https://data.mendeley.com/datasets/fvtfjyvw7d/2). This dataset is shared by Dr. Jibo HE, founder of the USEE Eye Tracking Inc. and professor of Tsinghua University. (HE, 2020) . It contains many professors' information from different universities. Professor name, school name, department name, local name, state name, year since first review, star rating, take again, difficulty index, tags, postdate, student star, student rated difficulty, attendance, would take again, grade. For this research, the new data set has been regenerated from the above dataset. The new dataset provided in Table 1 for model 1(figure1) consists of star rating, RMP rating, grades of students of twenty-nine faculties. For each faculty, the average of star rating, RMP rating of five students and the grades in numeric scale of them has been taken.

for model 2(figure:4), we modified the dataset given in table1. Instead of taking numerical grades, the frequency of grades of five students has been counted and stored in a dataset. The dataset is given in table 2 in appendix.

3.2 Procedure

The study has been accomplished by the following procedure. At the beginning a hypothesized model was made (Figure 1, appendix) to demonstrate the relationship between constructs. Then, confirmatory factor analysis was conducted for the measurement model. And finally, SEM (structural equation model) has been used to test the hypothesized model with empirical data.

CHAPTER 4

Analysis and results

4.1 Model 1

Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity has been conducted on the dataset to test the convenience of factor analysis. The result of KMO is .634 which is acceptable and Bartlett's test is less than .05 is significant. (Table 3)
In this model there are two constructs teaching evaluation which is labeled as TE and the other one is Grades. In this model teaching evaluation has directional impact on grades which is shown in (Figure1) . Here teaching evaluation is an exogenous variable and grades is an endogenous variable.
Teaching evaluation: This construct is reflected by the indicator's student rating and RMP rating. The Cronbach's alpha value of these indicators is .837 which is very good. It indicates reliability is good enough.

Grades: The construct is reflected by the indicators S1_grade, S2 _grade, S3_grade, S4_grade, S5_grade. The Cronbach's alpha value of this indicator is .67 which means it's reliability is minimally accepted and the cronbach's alpha value is shown in table4. Means and standard deviation of the indicators is given in Table 6.

Confirmatory factor analysis of this model (Figure 2) indicates composite reliability of TE and grades are .94 and .7 respectively which is acceptable. The AVE value of TE is .8 which is good but for grade is .4 (less than .5) which is not good. The correlation between TE and grades is positive and the value is .462 (Table 7).

The further step of analysis is to test the structural model (Figure3). The p value for this model is significant except for Grades to S1_grade.the standardized regression weights, p value is given in(Table 5). There are many fit indices to assess the model fit. For this model, I am providing the four major model fit measures CMIN/DF, PCLOSE, RMSEA, CFI in the table and all of them are excellent. It means the sample data fit the model excellently (Table 8).

Hence, the outcome of SEM implies that the standardized factor coefficient is large between endogenous and exogenous variables and there is a positive impact of exogenous variable teaching evaluation of endogenous variable grades. The value is .462. It indicates the extent to which exogenous variables influence endogenous variables.

4.2 Model 2

Here, the result of KMO is .123 which is very low and not acceptable (Table 9).Though the barrettes test result is significant for dataset 2.In this model, the two are teaching evaluation (label as TE) and grade frequency (label as GF).

Teaching evaluation: This construct is reflected by the indicators student rating and RMP rating. The Cronbach's alpha value of these indicators is .837 which is very good.

Grade frequency: this construct is reflected by the frequency letter grade A, A+, A-, B+,B,B-,C,C+,C-,D+,D,D-,F label AS AP,A,AM,BP,B.BM ,C,CP ,D,DM,F.(figure:4) No faculty has given C-, D+ grade to any of student. They have zero variance so further analysis could not be conducted. For that, they are removed in a modifying model (Figure 5). The Cronbach's alpha value of these

indicators -41.067 which violates reliability model assumption. (Table 10). The mean and standard deviation of indicators are given in (Table 11).

After conducting CFA, (Figure 6) the value of CR and AVE is good there is no validity concern here fig. The correlation between TE and GF is very low .01(Table 12).
The structural analysis shows that the model fit measures are terrible as only CMIN/DF is excellent. (Table 13) It is not supported by sample data in the structural model. The standardized factor coefficient is 0 between endogenous and exogenous variables which means there is no influence.

CHAPTER 5

Conclusion & discussion

In this study, two models have been proposed. Model-1 shows the directional relation between teaching evaluation and student grades and model two shows no relation between teaching evaluation and grade frequency. Between these models, model 1 is significant; model 2 is not acceptable due to poor model fit. In model 1, the results indicate that teaching evaluation has a positive impact on student grades. A change of 1 standard deviation in teaching evaluation is associated with a change of .474 standard deviation of grades. There are further many scopes to verify this research from different perspectives. A model has been given in index (Figure:9) where marking, question pattern, exam syllabus are the indicators of student satisfaction construct which has an impact in association between teaching evaluation and grades. Researchers can use many dimensions to conduct research on this subject.

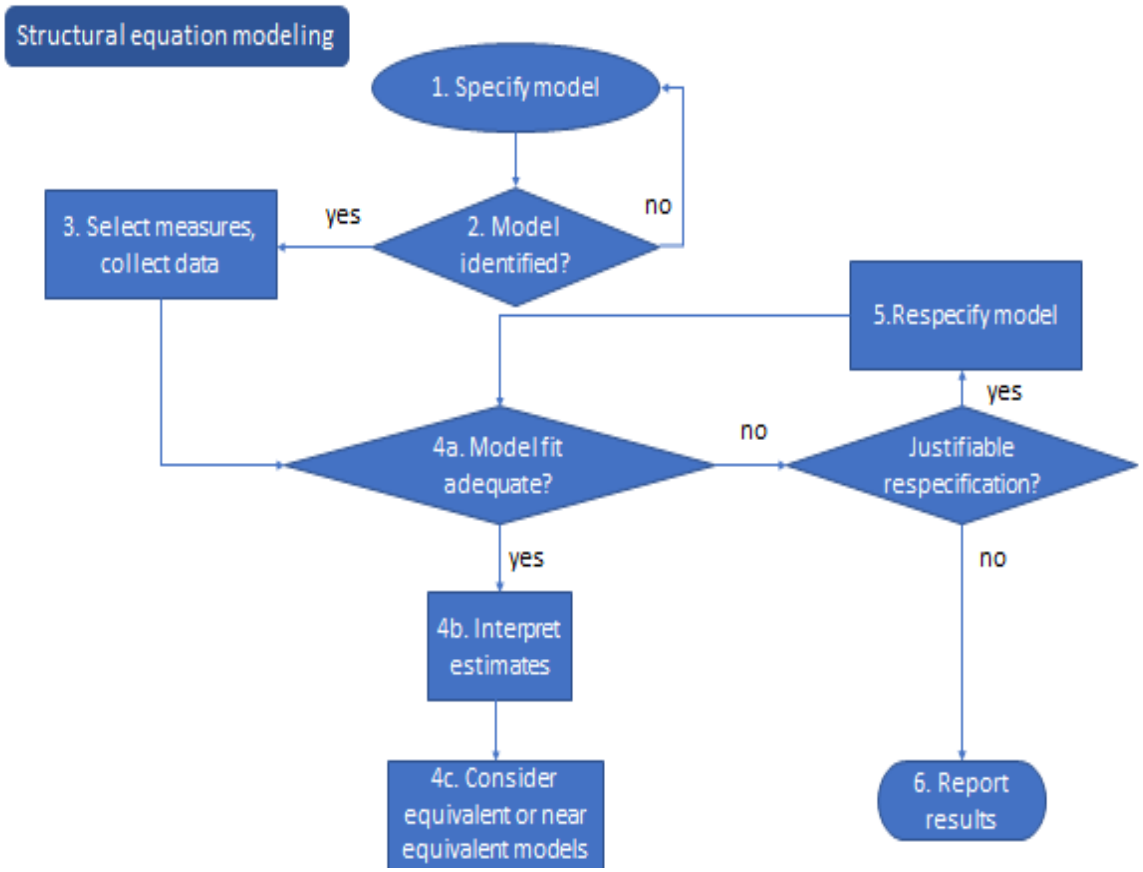
Appendix

Structural equation modeling

Structural equation modeling is a multivariate statistical analysis technique that is used to analyze the structural relationship between measured variables and latent constructs. This technique is the combination of factor analysis and multiple regression analysis is used to analyze the structural relationship between measured variables and latent constructs . In this analysis, there are two sorts of variables: endogenous variables and exogenous variables. Endogenous variables are equivalent to dependent variables and are equal to the independent variable. (Complete Dissertation, 2022) y. The goal of SEM analysis is to determine the extent to which the theoretical model is supported by sample data (Randall E. Schumacker, 2010) .

The steps of structural equation modeling is given below:

1. Specify the model.
2. Evaluate model identification (if not identified, go back to step 1).
3. Select the measures (operationalize the constructs) and collect, prepare, and Screen the data.
4. Estimate the model:
Evaluate model fit; if poor, respecify the model, but only if doing so is justifiable (skip to step 5); otherwise, retain no model (skip to step 6).
Assuming a model is retained, interpret the parameter estimates.
Consider equivalent or near-equivalent models (skip to step 6).
5. Respecify the model, which is assumed to be identified (return to step 4).6. Repot the results (Kline, 2016)



(Kline, 2016)

In conclusion, the Structural equation model is one of the powerful statistical method. It is mostly used in social science and behavioral science.

Confirmatory factor analysis: it tests the significance of a hypothesized factor model—that is, whether the sample data confirm that model. (Randall E. Schumacker, 2010) Confirmatory factor analysis (CFA) is a multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs. (complete dissertation, 2022)

Reliability and validity

AVE: Average variance extracted (AVE), is commonly used to validate constructs. In statistics, AVE is a measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error. (Cirillo, 2021)

CR: Composite reliability measures how well variables underlying constructs served in structural equation modeling. In construct reliability is depicted using confirmatory factor analysis (CFA). (Chetty, 2021)

P-value: It is the level of marginal significance within a statistical hypothesis test, representing the probability of the occurrence of a given event.

Model fit Indices:
CMIN/DF: chi-square fit statistics/degree of freedom RMSEA: Root mean square error of approximation
CFI: Comparative fit index
Pclose: Pclose is the p value.
The criteria for model fit indices is given in the appendix.

Figures

Model1:

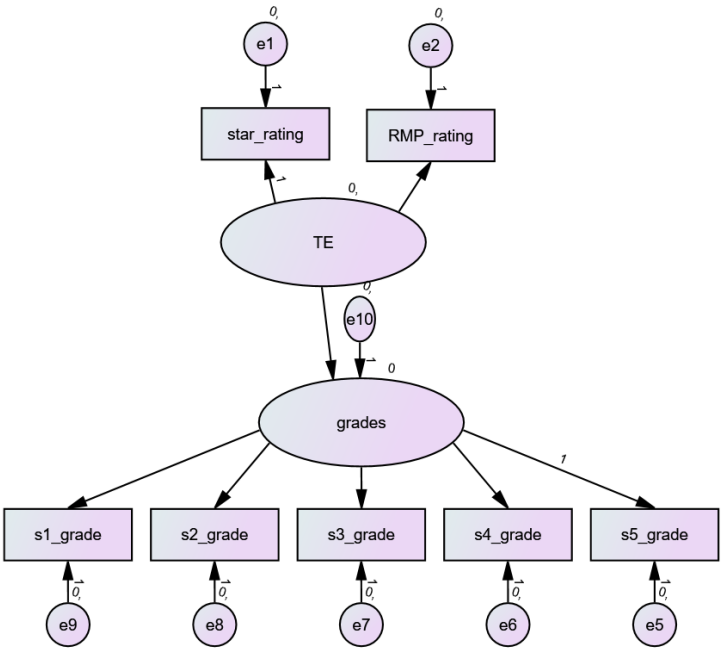


Figure 1 : hypothesized model 1

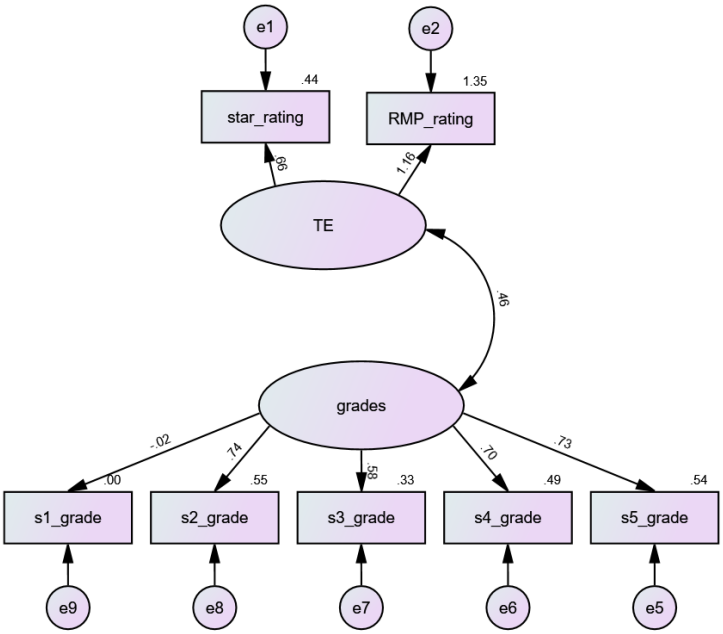


Figure 2: CFA of model 1

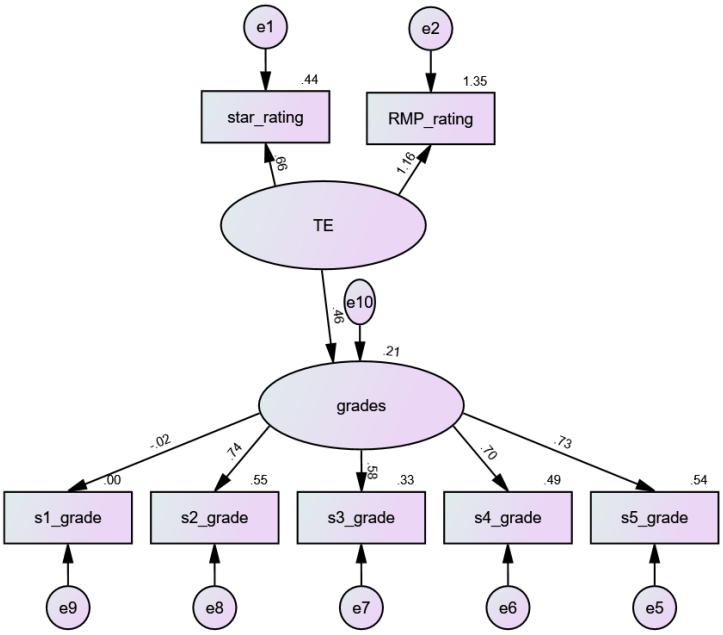


Figure 3:structural analysis of model 1

Model2:

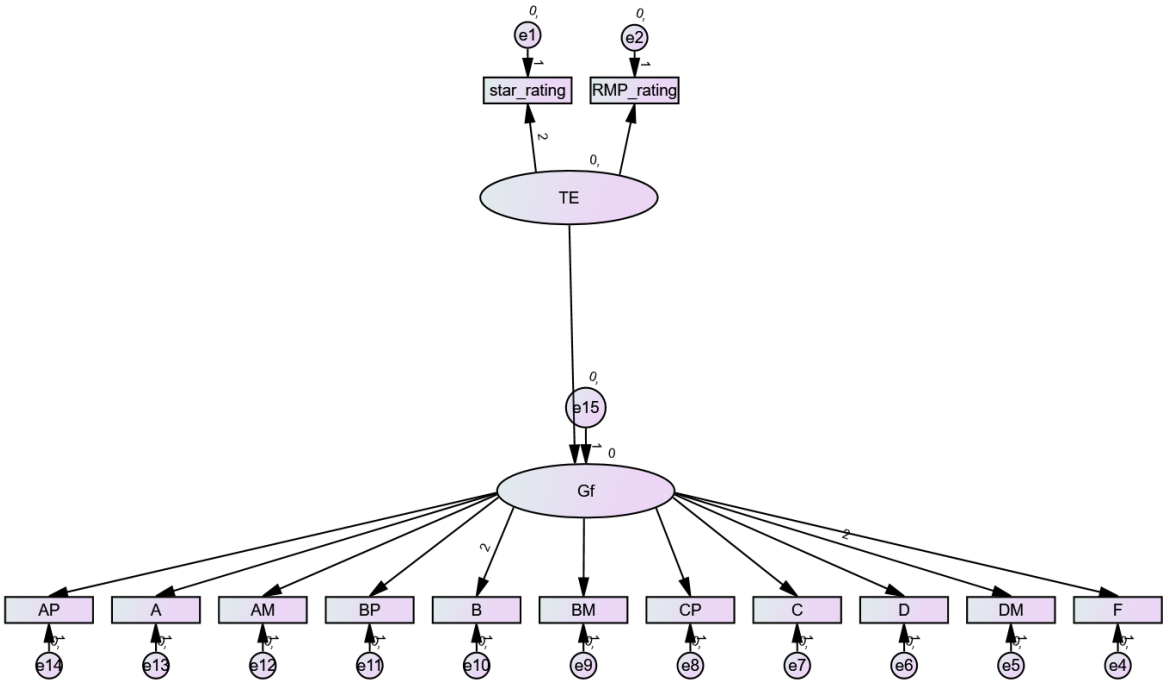


Figure 4: hypothesized model 2

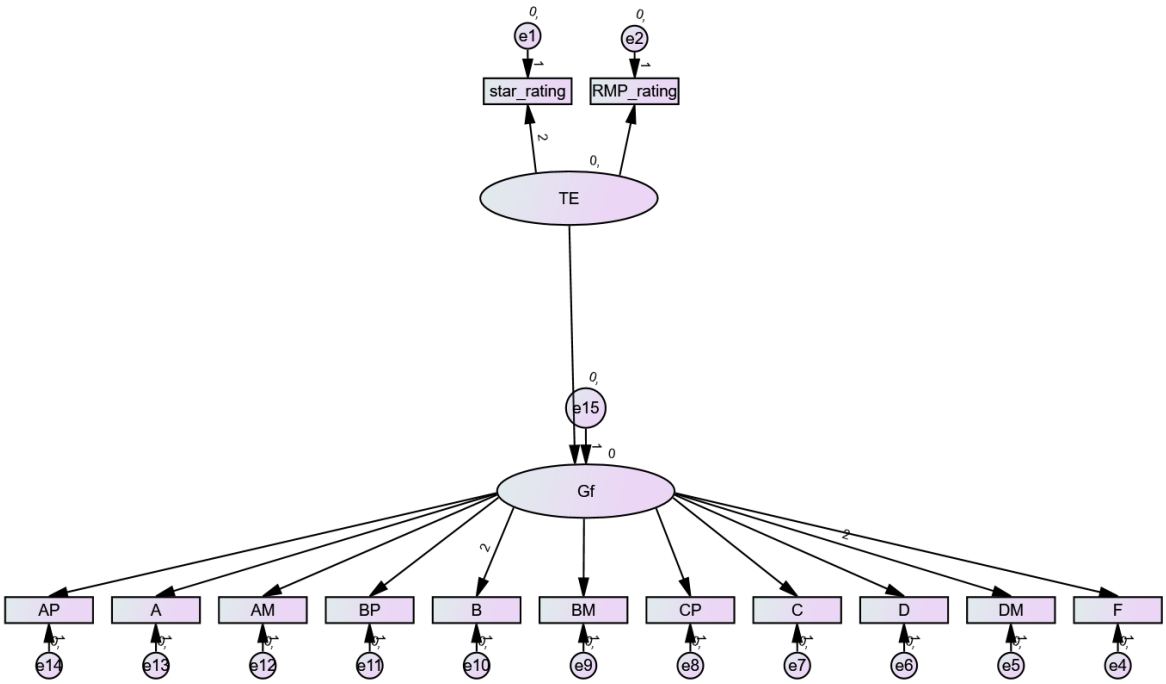


Figure 5:modification of model *2*

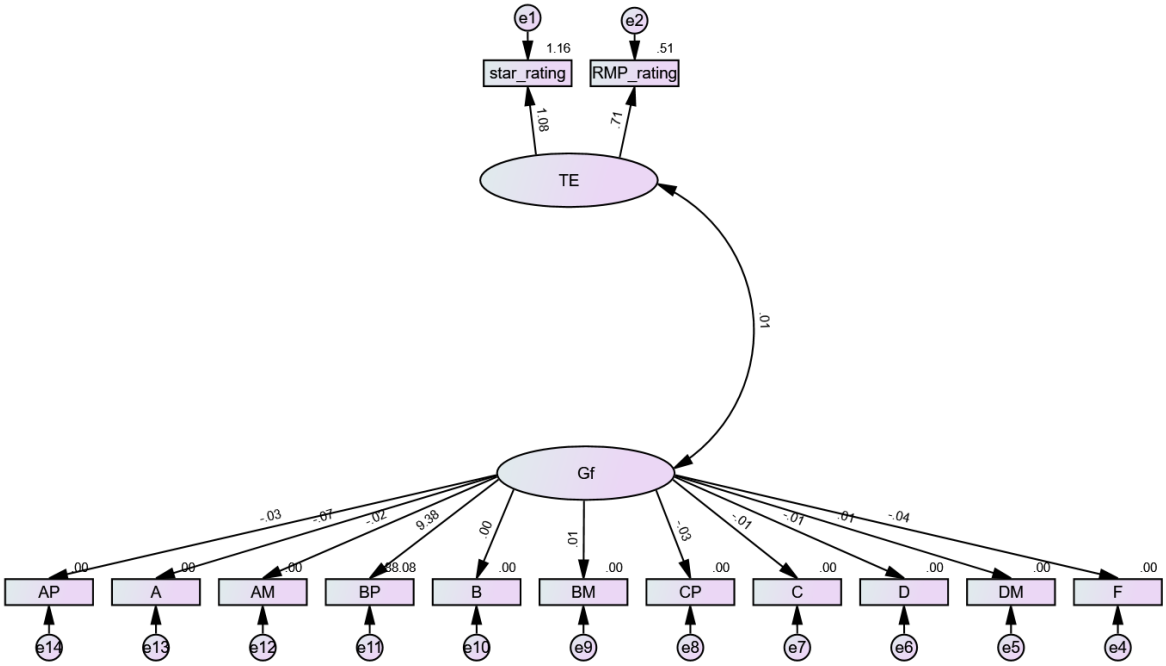


Figure 6 : CFA of model 2

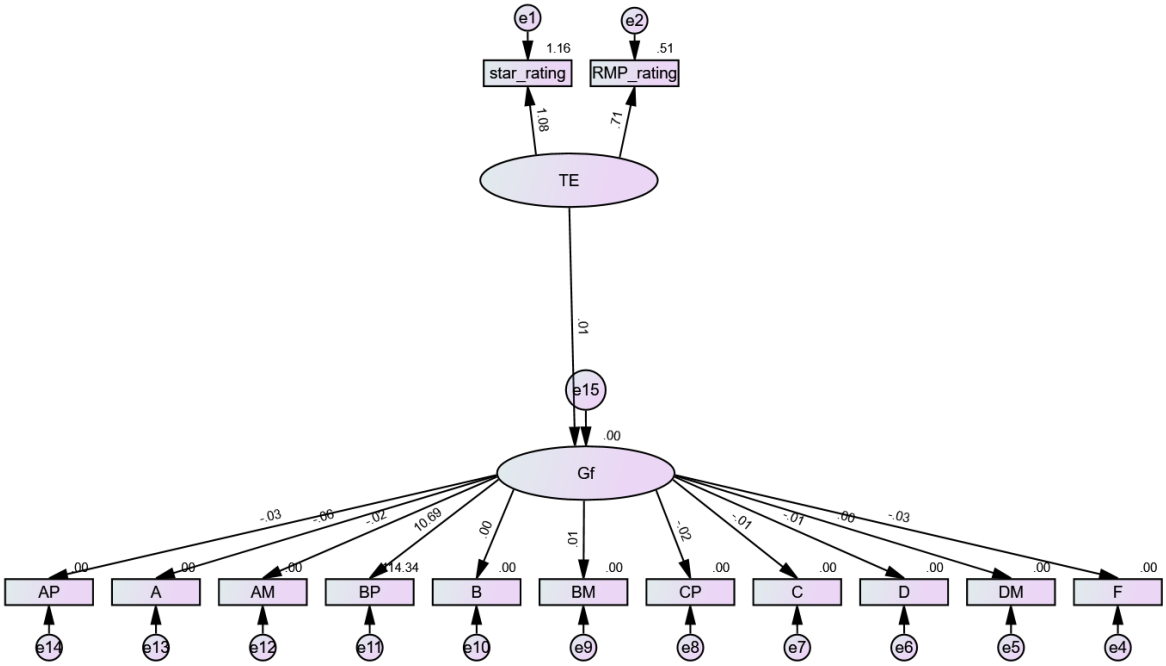


Figure 7 :structural analysis of model 2

Scope:

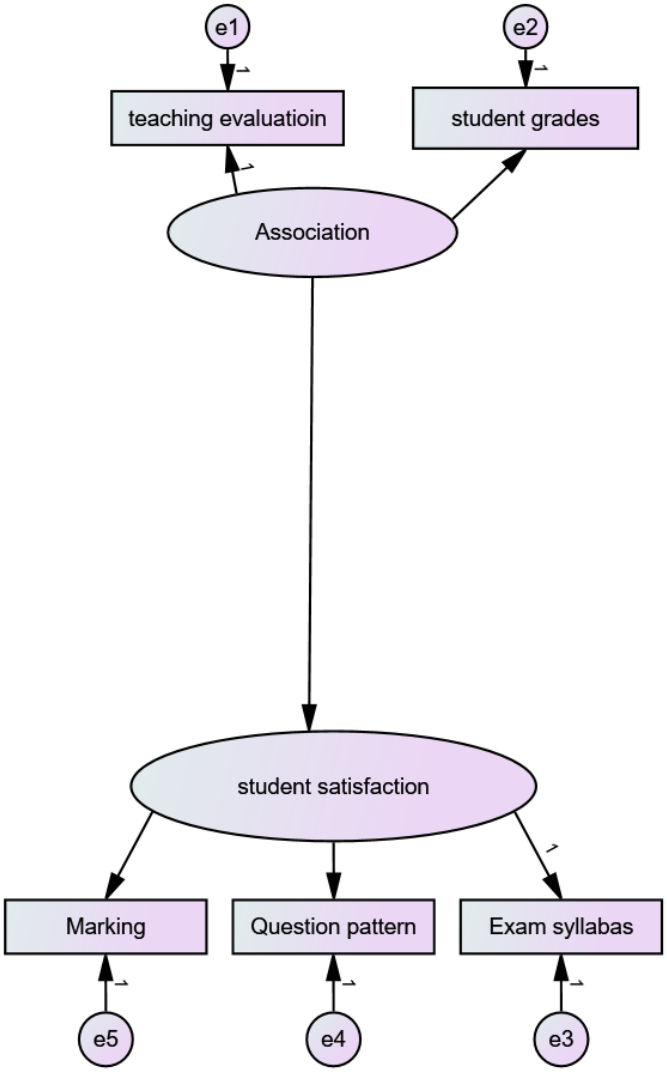


Figure 8 : model 3

Tables

Samples:

Table 1

dataset 1

professor_name	star_rating	RMP_rating	s1_grade	s2_grade	s3_grade	s4_grade	s5_grade
Jans Wager	4.5	4.5	3.9	3.9	3.7	3.9	3.9
William Hollinrake	1.6	1	3.9	3.9	3	2	3.7
Candice White	3.7	3.9	3	3.9	3.9	3.7	2
Pat Ledbetter	3.5	3.4	4	3.7	3	3.7	3.3
Diane Reid	4.5	4.2	3.7	3.9	3	3.3	4
Eleanor Branch	3.4	2.9	3.7	3.3	4	3.7	3
Jeffrey Kent	3.7	4.6	4	4	4	3.3	4
Angelica Vessella	4.4	4.9	3.9	3.9	3.9	3	3.7
Matthew Erdelyi	2.6	2.1	3.3	3.9	3	2.3	3.9
Daniel Kurylo	3.3	4.4	3.9	4	3.9	3	2.3
Aaron Kozbelt	4.7	4	3	3.3	3.9	3.9	4
Ashraf Shirani	3.5	2.6	2.7	2.3	3	3.3	3.9
John Moliassa	4.3	4.9	4	3.3	3.9	3	3
Roger Strong	3.5	3.7	3.3	3	3	3.3	3.9
Thomas Cooke	3.2	3.5	3.9	3.7	3.9	3.9	3.9
Lashun Griffin	3	2.8	0.7	3	3	3.3	3.3
David Rayson	4.7	4.6	4	3.9	3.9	3.9	3.9
Max Smith	3.8	2.2	3.9	1	2	3.9	2.3
Ian Wojcik-Andrews	3.7	4.8	4	4	4	3.9	3.9
Rex Abert	3.7	4.2	3.9	3	4	3	4
John Burk	4.9	5	3	3.7	2.7	3.3	3.3
Jennifer Jossendal	3.1	2.8	3.9	0	4	2.7	3
Fred Stewart	4.4	4.4	2.3	3.9	4	3.3	4
David Gallaher	3.8	3	3	3	2.3	3	3.9
Kenny Peters	3.3	2	3.9	0	0	0	0
Craig Stettner	3.9	4.8	3.9	2	2	4	3.3
Todd Ballantyne	4.7	4.2	3.9	3.9	0	3.9	3.9
Brandie Siegfried	3.9	3.8	3.7	3.7	3.9	3.3	2.7
Shahinda Hafeez	3.5	3	3.9	3.9	3.9	4	4

Table 2

Dataset 2

professor_name	star_rating	RMP_rating	AP	A	AM	BP	B	BM	CP	C	CM	DP	D	DM	F
Jans Wager	4.5	4.5	0	4	1	0	0	0	0	0	0	0	0	0	0
William Hollinrake	1.6	1	0	2	1	0	1	0	0	1	0	0	0	0	0
Candice White	3.7	3.9	0	2	1	0	1	0	0	1	0	0	0	0	0
Pat Ledbetter	3.5	3.4	1	0	2	1	1	0	0	0	0	0	0	0	0
Diane Reid	4.5	4.2	1	1	1	1	1	0	0	0	0	0	0	0	0
Jeffrey Kent	3.7	4.6	4	0	0	1	0	0	0	0	0	0	0	0	0
Angelica Vessella	4.4	4.9	0	3	1	0	1	0	0	0	0	0	0	0	0
Matthew Erdelyi	2.6	2.1	0	2	0	1	1	0	1	0	0	0	0	0	0
Daniel Kurylo	3.3	4.4	1	2	0	0	1	0	1	0	0	0	0	0	0
Aaron Kozbelt	4.7	4	1	2	0	1	1	0	0	0	0	0	0	0	0
Ashraf Shirani	3.5	2.6	0	1	0	1	1	1	1	0	0	0	0	0	0
John Moliassa	4.3	4.9	1	1	0	1	2	0	0	0	0	0	0	0	0
Roger Strong	3.5	3.7	0	1	0	2	2	0	0	0	0	0	0	0	0
Thomas Cooke	3.2	3.5	0	4	1	0	0	0	0	0	0	0	0	0	0
Lashun Griffin	3	2.8	0	0	0	2	2	0	0	0	0	0	0	1	0
David Rayson	4.7	4.6	1	4	0	0	0	0	0	0	0	0	0	0	0
Max Smith	3.8	2.2	0	2	0	0	0	0	1	1	0	0	1	0	0
Ian Wojcik-Andrews	3.7	4.8	3	2	0	0	0	0	0	0	0	0	0	0	0

Rex Abert	3.7	4.2	1	2	0	0	2	0	0	0	0	0	0	0	0
John Burk	4.9	5	0	0	1	2	1	1	0	0	0	0	0	0	0
Jennifer Jossendal	3.1	2.8	1	1	0	0	1	1	0	0	0	0	0	0	1
Fred Stewart	4.4	4.4	2	1	0	1	0	2	1	0	0	0	0	0	0
David Gallaher	3.8	3	0	1	0	0	3	0	1	0	0	0	0	0	0
Kenny Peters	3.3	2	0	1	0	0	0	0	0	0	0	0	0	0	4
Craig Stettner	3.9	4.8	1	1	0	1	0	0	0	2	0	0	0	0	0
Todd Ballantyne	4.7	4.2	0	4	0	0	0	0	0	0	0	0	0	0	1
Brandie Siegfried	3.9	3.8	0	1	2	1	0	1	0	0	0	0	0	0	0
Shahinda Hafeez	3.5	3	2	3	0	0	0	0	0	0	0	0	0	0	0

Model 1:

Table 3

KMO and Bartlett's Test of model 1

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.634
Bartlett's Test of Sphericity	Approx. Chi-Square	67.621
	df	21
	Sig.	.000

Table 4

Reliability Statistics of model 1

Cronbach's Alpha	N of Items
.669	5
.837	2

Table 5

Standardized Regression Weights and p value of model 1

	Standardized Regression Weights	p
grades - TE	.462	.024
star_rating -TE	.664	
RMP_rating -TE	1.161	.030
s5_grade - grades	.733	
s4_grade - grades	.698	.002
s3_grade - grades	.577	.007
s2_grade - grades	.740	***
s1_grade - grades	-.016	.939

Table 6

means and standard deviation of model 1

	Mean	Std. Deviation	Analysis N
star_rating	3.752	.7164	29
RMP_rating	3.662	1.0462	29
s1_grade	3.524	.7140	29
s2_grade	3.207	1.1272	29
s3_grade	3.200	1.0889	29
s4_grade	3.269	.8094	29
s5_grade	3.379	.8768	29

Table 7

Validity Analysis of model 1

	CR	**AVE**	**MSV**	**MaxR(H)**	**TE**	**grades**
TE	0.940	0.895	0.213	1.480	**0.946**	
grades	0.707	0.381	0.213	0.793	0.462	**0.617**

Table 8

model fit indices of model 1

Measure	Estimate	Threshold	Interpretation
CMIN	13.087	--	--
DF	13.000	--	--
CMIN/DF	1.007	Between 1 and 3	Excellent
CFI	0.998	>0.95	Excellent
RMSEA	0.015	<0.06	Excellent
Pclose	0.509	>0.05	Excellent

Model 2:

Table 9

KMO and Bartlett's Test of model 2:

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.123
Bartlett's Test of Sphericity	Approx. Chi-Square	164.267
	df	78
	Sig.	.000

Table 10

Reliability Statistics of model 2:

Cronbach's Alpha[a]	N of Items
-41.067	11

Table 11

mean and standard deviation of model 2

	Mean	Std. Deviation	Analysis N
star_rating	3.764	.7263	28
RMP_rating	3.689	1.0549	28
AP	.71	1.013	28
A	1.71	1.243	28
AM	.39	.629	28
BP	.57	.690	28
B	.79	.833	28
BM	.21	.499	28
CP	.21	.418	28
C	.18	.476	28
D	.04	.189	28
DM	.04	.189	28
F	.21	.787	28
CM	.00	.000	28
DP	.00	.000	28

Table 12

Validity Analysis of model 2

	CR	AVE	MSV	MaxR(H)	TE	Gf
TE	0.907	0.836	0.000	1.195	**0.914**	
Gf	11.367	8.008	0.000	375.435	0.014	**2.830**

Table 13

model fit indices of model 2

Measure	Estimate	Threshold	Interpretation
CMIN	145.495	--	--
DF	65.000	--	--
CMIN/DF	2.238	Between 1 and 3	Excellent
CFI	0.357	>0.95	Terrible
RMSEA	0.214	<0.06	Terrible
PClose	0.000	>0.05	Not Estimated

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