

A First Order Confirmatory Factor Analysis of Composite Indicators of Teaching Talent for Teacher Trainees Students

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Abstract: The purpose of this study is to develop composite indicators of Teaching Talent (TT) for teacher trainees students, and verify the fit of the indicators with empirical data. There are three stages to be taken in this study, namely stage (1) the validity and reliability of item test by Cronbach's Alpha, (2) construct validity test by exploratory factor analysis, and (3) construct validity test by first order confirmatory factor analysis. The data gathering in the year 2015 were collect to the research samples by proportional random sampling, 131 units answer Buckingham & Clifton's rating scale (9 scale of questionnaire), but only 117 units that answer completely information were used for analysis by the first order confirmatory factor analysis (CFA). The research results shown that, composite indicator from development consisted of 4 main components and 16 indicators were fitted with the empirical data, determined from the Chi-square values = 133.43, and not statistical significance ($p = 0.97223$) at zero degrees of freedom ($df = 98$) indicated that model not different from the empirical data. In addition found the relative Chi-square was 1.36, GFI = 0.97, AGFI = 0.93, RMSEA = 0.05, CFI = 0.92, and Q-plot curve steeper than the diagonal, indicated that composite indicators model not different from the empirical data.

Keywords: composite indicators, scaling method, teaching talents, prospectives teacher.

1. INTRODUCTION

The admission of new teacher trainees in Indonesia has not considered the teaching talent. Generally, special aptitude test is intended only to teacher trainees in painting, dance, and craft arts as well as physical and sport education. In other fields such as science, social studies, and language, admission is generally based on admission test. In fact, a special teaching talent test can be a parameter that can be used as a prediction for a teacher trainee when he/she becomes a professional teacher in the future. In this country, the poor quality of learning outcomes cannot be separated from teacher's ineffectiveness of learning, which can be tracked from the main problem, i.e. lack of teacher competence (Bjork, 2013; World Bank & Ministry of Education and Culture RI, 2010). This substantial problem may occur in the teacher trainee education and weakness in recruitment that has not considered the teaching talents.

As argued by Pali (2011), deferential intelligence and talent have a very significant predictive value on learning achievement and field of job. According to Sajan (2010), teaching talent is a major determinant and a significant predictor for teacher's effectiveness. Teaching talent has a significant correlation with the success of teaching. The result shows that the admission test for teacher education program can not explain teacher trainee's teaching talent. Therefore, he suggested that the teaching talent test becomes a part of the admission tests for the teacher trainee education.

Results of the study by Ushakumari (2011), suggested that among the four predictors examined, attitude toward the teaching profession is a single predictor for the teaching talents more significant than the other three predictors such as interest, perception, and self-concept on the teaching profession.

Other studies on the teaching talents among teachers and teacher trainees are very diverse, ranging from the period of time required for a teacher education program (Shukla, 2010); difference in teaching talent between students of public and private of educational institute for educators and support staff (Ganoje, 2011); relationship between teaching talent and attitude toward the teaching profession (Kanti, 2013); how teachers in the future have the strong teaching talent (Chugh, 2012); teaching talents and the relationship with a sense of responsibility and differences in gender and (rural-urban) job location (Kanti, 2011).

Therefore, it is time for every teaching trainee educational institution to develop the teaching talent test in order to obtain the teaching trainees with high teaching student who may become professional teachers in the future. The study focuses on the instrumentation of teaching talent test tools developed based on the general theory of aptitude from the Gallup Organization. The teaching talents in the study are in forms of thoughts, feelings, and naturally repetitive behaviors that can be applied as something productive (Buckingham & Clifton, 2001), especially in instructional. Teaching talents refer to the strong and weak specific potential ability of a teacher trainee before he/she decides to choose the teaching profession as the way of life. The teaching talent can be tracked through answers to a question why he/she wants to teach (Cruickshank, Jenkins & Metcalf, 2012) and through talent recruitment, strengthening, and enhancement models (Curtis & Wurtzel, 2010).

The instrumentation of the teaching talent test examined the composites of teaching talent factors as follows: (1) a preference for the teaching profession; (2) educational communication skills; (3) empathy for the child; and (4) a human learner.

2. RESEARCH METHOD

2.1. Data Gathering:

According to Gable & Wolf (1993), there are several ways to measure the noncognitive or affective instruments, for example, by an equal appearing interval method as developed by Thurstone; Likert scaling model; latent trait method by Wright & Masters, and semantic differential method of Osgood. In this study, a questionnaire with a rating scale developed by Buckingham & Clifton (2001) of the Gallup Organization was used. The model contains various statements as indicators of teaching talent with a range of answer choices from 1 for the response 'profoundly disagree' up to 9 for the response 'profoundly agree'. Students were asked to assess themselves against the choices of 1-9. Total score indicates the strong or weak teaching talent of students.

2.2. Subjects:

Samples for testing the instrument of the study were 131 students from ten study programs in Faculty of Teacher Training and Education, University of Jember, Indonesia (Fakultas Keguruan dan Ilmu Pendidikan Universitas Jember, Indonesia). They were selected by a proportional random sampling technique. Data tabulation was done based on the data collected using the instrument and formatted in a form of MS Excel. The data were analyzed after screening with a total number of 117.

2.3. Development and checking of instrument quality:

According to Gable & Wolf (1993), there are six steps in the development of instrument, namely: (1) the formulation of concepts, operational definitions and indicators and item writing; (2) test; (3) instrument revision; (4) data collection; (5) validity and reliability test; and (6) reporting. All the steps were reached. This article was the step 6, including the steps 4 and 5.

2.4. Data Manipulation and analysis:

The validity and reliability of teaching talent instrument were examined to describe how valid and reliable the instrument can be used to measure indicators of the variable "teaching talent". The validity and reliability test was done in three steps, i.e. (1) validity and reliability of item test by Cronbach's Alpha, (2) construct validity test by exploratory factor analysis, and (3) construct validity test by first order confirmatory factor analysis. The validity and reliability test was done using SPSS (Statistical Package for Social Science) for Windows version 20, meanwhile, the construct validity

using a confirmatory factor analysis was conducted using LISREL 8.80 (the copyright of the Research Institute, University of Jember).

3. RESULTS AND DISCUSSION

To get a standardized instrument, the test is usually performed repeatedly. In this study, the test was only done once and for further analysis, validity and reliability tests were carried out by using the statistical tools available. The concept of validity means that an instrument is said to be valid if it is able to accurately describe the dimensions of what to be measured, or the precision and accuracy of the measuring instrument in performing the function to measure. Reliability implies that the measuring instrument is said to be reliable if the measurement result can be reliable (Garson, 2013; Hair, et.al., 2006).

The validity and reliability test of teaching talent instrument in this study was done in three steps.

Based on the method of Cronbach's Alpha, there are two basic provisions to be used as standards to determine whether or not an item is valid and reliable.

1. The significance of the Pearson correlation coefficient, i.e. the item-total correlation, should be $>.40$. If the item-total correlation is less than the significance, the item must be excluded from analysis (Leech, et.al., 2012).
2. Cronbach's Alpha coefficient (CAC) and Standardized Item Alpha (SIA) are average inter-item correlation where the item has the same variance. In essence, SIA is Spearman-Brown reliability where an instrument is said to be valid and reliable if CAC and SIA coefficients $>.60$ for an exploratory study and $>.70$ for a confirmatory study (Garson, 2013; Leech, et.al., 2012).

The data analyzed were continuous data as results of the measurement of teaching talent 40-items questionnaire. Teaching talent is theoretically a reflection of four main factors, i.e. preference for the teaching profession (items 1-10), educational communication skills (items 11-20), empathy for the child (items 21-30), and a human learner (items 31 -40).

Item analysis with the first standard consisted of two rounds. Results of the analysis of the first round for each factor with Cronbach's Alpha showed that total items that were valid and reliable were 23 items, 6 items were valid and reliable for the component of preference for the teaching profession; 6 items were valid and reliable for the component of educational communication skills; 6 items were valid and reliable for the component of empathy for the child; and 5 items were valid and reliable for the component of human learner.

Furthermore, the validity and reliability tests of items for the second round included all items. Based on the analysis, the valid and reliable total items to test that included all the items were 21 items, where 6 items were valid and reliable for the component of preferences for the teaching profession; 6 items were valid and reliable for the component of educational communication skills; 5 items were valid and reliable for the component of empathy for the child; and 4 items were valid and reliable for the component of human learners.

Results of the validity and reliability test with the second standard based on the interpretation of Cronbach's Alpha coefficient (CAC) and the Standardized Item Alpha (SIA) is summarized in Table 1.

Table 1. Summary of the Validity and Reliability Tests with CCA and SIA

Components	CAC		SIA	
	Total Item	After Invalid Item Dropped-out	Total Item	After Invalid Item Dropped-out
Preference	0.749	0.855	0.743	0.868
Communication	0.758	0.741	0.767	0.752
Empathy	0.733	0.701	0.740	0.705
Learners	0.521	0.703	0.673	0.722
(Teaching talent)	0.830	0.851	0.854	0.856

Based on Table 1, it can be interpreted that the instrument of teaching talents generally met the criteria of validity and reliability because CAC and SIA were $>.60$ for exploratory study. In fact, CAC, according to Garson (2013), can be used

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for coefficient of validity and coefficient of reliability. In accordance with the results of analysis using the method of Cronbach’s Alpha, there were 21 valid and reliable items. The validity and reliability referred to the provisions that each valid and reliable item had the corrected item-total correlation $\geq .30$ (Cronbach, 1990) and Cronbach’s Alpha if Item Deleted $\geq .70$ (Leech, et. al., 2012).

However, to examine whether or not the instrument of teaching talent met construct validity theoretically, empirically, and statistically, an analysis was done at the second step, i.e. exploratory factor analysis. According to Hair, et.al., (2006), for the noncognitive instrument, construct validity (in this case factorial validity) is generally used as a validation tool.

The exploratory factor analysis was done to select valid and reliable items in the whole instruments theoretically in accordance with criteria of factor loading of $\geq .50$ (Hair, et. al., 2006; Cronbach, 1990; Leech, et. al., 2012). The standards used for further analysis for statistical support are as follows:

1. Coefficient of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KOM-MSA) is $\geq .50$ at $p \leq .05$ (Leech, et al, 2012).
2. Coefficient of the Anti-Image Correlation (coefficient of correlation with sign a with a diagonal direction from top left to bottom right) of each item is $\geq .50$; if it is $< .50$, the item is excluded.
3. Extraction of statistically significant item has loading $\geq .50$.
4. Although an item has a loading factor of $\geq .50$, if theoretical assumptions are not met, i.e. being extracted into inappropriate indicators, the item is excluded.

The exploratory factor analysis of the teaching talents instrument was done as much as 6 rounds for meeting all the standards of analysis. The results of the sixth (last) round as presented in Table 2 show that the coefficient of KMO-MSA was 0.755, significant at $p < .05$.

Table 2. KMO-MSA Statistics

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.755
Bartlett's Test of Sphericity	Approx. Chi-Square	724,608
	df	120
	Sig.	.000

The results of the last round show that no item had the coefficient of Anti Image Correlation $< .50$. Sixteen valid items were found to be the teaching talent instrument, as follows: 6 items for the indicator of preference for the teaching profession (items 1-6); 4 items for the indicator of educational communication skills (items 7-10); 3 items for the indicator of empathy for the child (items 11-13), and 3 items for the indicator of human learners (items 14-16). Based on the rotated component matrix, all the 16 items could be interpreted as valid items because no factor loading was $< .50$. Table 3 shows indicators of the items of four components studied.

Table 3. Components and the Indicators of Teaching Talents

Variables	Components	Indicators	Item Number
	The preference for the teaching profession	<ul style="list-style-type: none"> • Proud of the teaching profession. • Aspiring to become a teacher early. • Following teaching education on their own volition and no one forces. • Refusing to another job besides teaching profession. • Making the teaching profession as a choice and a way of life. • Placing the teaching profession as a most attractive profession compared to other professions. 	1-6
		<ul style="list-style-type: none"> • Have confidence to be a good speaker in every occasion. • Feeling superior in storytelling or telling a story. 	7-10

Variables	Components	Indicators	Item Number
Teaching Talent	Educational communication skills	<ul style="list-style-type: none"> Always sharing ideas, thoughts and ideas with others. Always reading references or books in daily life. 	
	Empathy for the child	<ul style="list-style-type: none"> Always great to hang out with the kids. Feeling full responsibility to the kids when they were in school. Feeling a part of life of children in daily life. 	11-13
	As human learners	<ul style="list-style-type: none"> Readiness to learn anything, anywhere, and anytime. Making learning difficulties as challenges that must be dealt with knights. Having a life principle to always learn from anybody. 	14-16

Furthermore, the results of screen plot as presented in Figure 1 show that the eigenvalue was ≥ 1 , so it can be interpreted that all the 16 items were extracted into four factors in accordance with the theoretical assumptions and supported by statistical evidence.

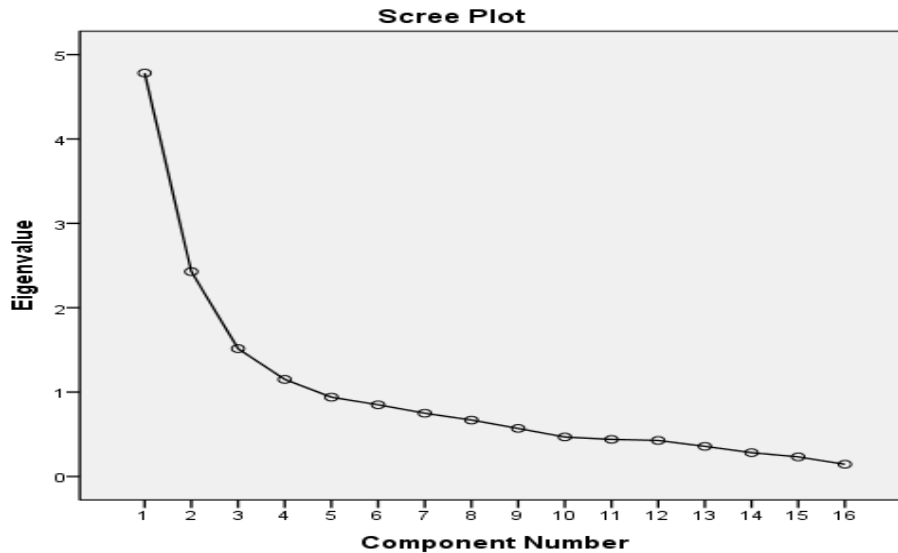


Figure 1. Scree Plot of Exploratory Factor Analysis

The result of exploratory factor analysis indicating that the instrument was valid and reliable is not enough to assure that the conceptual model of teaching talent was completely identical or in accordance with the theoretical construction. To validate whether or not the model constructed confirmed with empirical data, construct validity and reliability tests through a first order confirmatory factor analysis were carried out. In the analysis at the third step, H_0 stating that “the empirical data are identical with the theory/model” was also examined. The parameters used were below.

Fit analysis of composite indicators with empirical data by first order confirmatory factor analysis (CFA) with LISREL version 8.80 (the copyright of the Research Institute, University of Jember) based on the coexistence of the criteria follows:

1. The Chi-square statistics will be reduced, while a statistically significant will be increased ($p > .05$), indicating that the model was fitted to the empirical data, but the degrees of freedom was greater than zero ($df > 0$) (Hair, et.al., 2006).
2. The ratio of Chi-square/df (relative chi-square) was less than 2 (Carmines & McIver, 1981).
3. Goodness of fit index (GFI) was between 0 and 1, if GFI values greater than 0.90 was generally considered to be acceptable (Jöreskog & Sörbom, 2000).

4. Adjusted Goodness of Fit Index (AGFI) more than 0,90 (Diamantopaulus & Siguaw, 2000).
5. Root Mean Square Error of Approximation (RMSEA) < 0.05 (Byrne, 1998).
6. Comparative Fit Index near 1 or > 0.90 (Bentler, 1990).
7. Q-Plot Curve steeper than the diagonal.

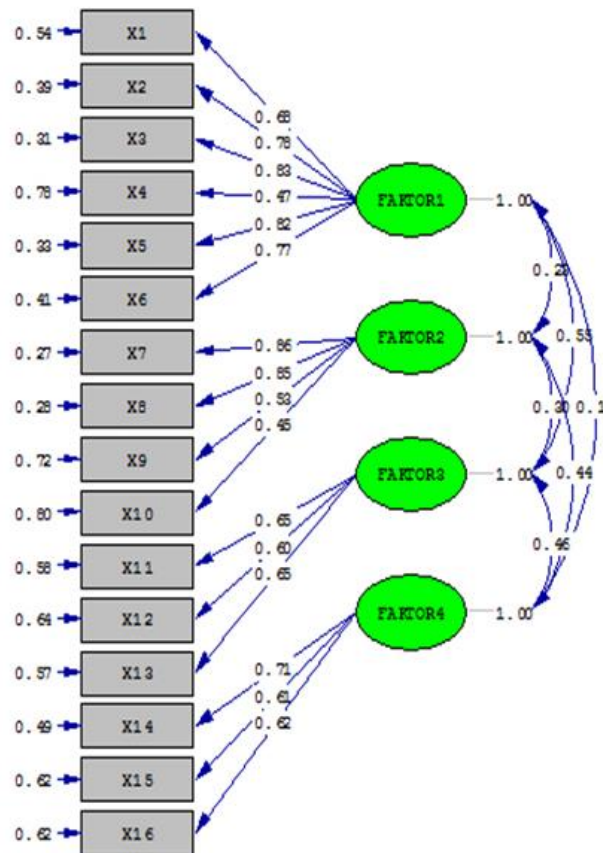
Based on the t values obtained, it can be interpreted that the four components actually reflected the teaching talent because the empirical data were identical with the theory/model. It also means that the conceptualized model fit could be said as good because all the 16 indicators become the factors.

The decision to accept the model fit was supported by statistical data as results of the analysis of *Goodness of Fit Model* as shown in Table 4 below.

Table 4. Goodness of Fit Model Statistics

No.	Indicators	Coefficient	Significance	Decision
1	Chi-square statistics	133,43	0.97223	Model Fit
2	χ^2/df	1,361	less than 2	Model Fit
3	Goodness of Fit Index (GFI)	0,974	> 0.90	Model Fit
4	Adjusted Goodness of Fit Index (AGFI)	0.926	> 0.90	Model Fit
5	RMSEA	0,056	≤ 0.05	Model Fit
6	Comparative Fit Index (CFI)	0,922	near 1, >0.90	Model Fit

The results of path diagram constructed as shown by Figure 2 also show that the conceptualized model fit could be said as good because it did show the red line of relations.



Chi-Square=133.43, df=98, P-value=0.97223, RMSEA=0.056

Figure 2. The Final Model of Composite Indicators of Teaching Talents

4. CONCLUSIONS

The research results shown that, composite indicator from development consisted of 4 main components and 16 indicators were fitted with the empirical data, determined from the Chi-square values = 133.43, and not statistical significance ($p = 0.97223$) at zero degrees of freedom ($df = 98$) indicated that model not different from the empirical data. In addition found the relative Chi-square was 1.36, GFI = 0.97, AGFI = 0.93, RMSEA = 0.05, CFI = 0.92, and Q-plot curve steeper than the diagonal, indicated that composite indicators model not different from the empirical data. Based on the conclusion of the study, the instrument of teaching talent is feasible to used to measure the teaching talents of prospective teachers.

5. RECOMMENDATION

Based on the research, educational institute for educators and support staff should initiate to plan the instrument teaching talent development and recruit teacher trainees students based on consideration of teaching talent. Prior to this research instrument used, researchers should reexamine the validity and reliability, and revise its as required.

REFERENCES

- [1] Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107: 238-246.
- [2] Bjork, C. (2013). Teacher training, school norms and teacher effectiveness in Indonesia. In Suryadarma, D. & Jones, G.W. (Eds.). *Education in Indonesia* (pp. 53-67). Singapore: Institute of South East Asian Studies.
- [3] Buckingham, M. & Clifton, D. (2001). *Now, discover your strenghts*. First Edition. New York: The Free Press.
- [4] Byrne, B.M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: basic concepts, applications and programming*. New Jersey: Lawrence Erlbaum Associates, Inc.
- [5] Carmines, E.G., & McIver, J.P. (1981). Analyzing models with unobserved variables. In G.W. Bohrnstedt & E.F. Borgatta (Eds.). *Social measurement: current issues*, Beverly Hills, CA: Sage.
- [6] Chugh, D. (2012). *Do the future teachers of Haryana have the aptitude to teach?* New Delhi: Centre for Civil Society, Summer Research Internship Programme.
- [7] Cronbach, L.J. (1990). *Essentials of psychological testing*. New York: Harper & Row Publishing.
- [8] Cruickshank, D.R., Jenkins, D.B., & Metcalf, K.K. (2012). *The act of teaching*. 6th ed. Singapore: McGraw-Hill Education (Asia).
- [9] Curtis, R.E. & Wurtzel, J. (Eds.). (2010). *Teaching talent: a visionary framework for human capital in education*. Cambridge, MA: Harvard Education Press.
- [10] Diamantopoulos, A. & Siguaw, J.A. (2000). *Introducing LISREL: a guide for the uninitiated*. Sage Publications.
- [11] Gable, R.K. & Wolf, M.B. (1993). *Instrument development in the affective domain* (2nd ed.). Boston: Kluwer Academic Publishers.
- [12] Ganoje, S.M. (2011). A comparative study of teaching aptitude of D.T.Ed. trainees of government and non government colleges. *International Referred Research Journal*, 11(21), 67-68.
- [13] Garson, G.D. (2013). *Validity and reliability*. New York: Blue Book Series, Statistical Associates Publishing.
- [14] Hair, J.F. Jr., Anderson, R.E., Tatham, R.L. & Black, W.C. (2006). *Multivariate data analysis*. (5th Edition). Upper Saddle River, NJ: Prentice-Hall International, Inc.
- [15] Jöreskog, K. & Sörbom, D. (2000). *LISREL 8: user's reference guide*. Chicago: Scientific Software International, Inc.
- [16] Kanti, K.S. (2013). A study of relationship between teacher attitude & teaching aptitude of prospective secondary school teachers. *International Journal of Education and Psychological Research*, 2(4), 95-98.

International Journal of Novel Research in Education and LearningVol. 4, Issue 2, pp: (145-152), Month: March – April 2017, Available at: www.noveltyjournals.com

- [17] Leech, N.L., Barrett, K.C. & Morgan, G.A. (2012). *IBM SPSS for intermediate statistics: use and interpretation*. 4th Editions. Marwah, NJ: Lawrence Erlbaum Associates.
- [18] Pali, M. (2011). *Kecerdasan dan bakat sebagai prediktor prestasi belajar siswa dan kinerja profesi*. Pidato Pengukuhan Guru Besar Bidang Psikologi Pendidikan pada Fakultas Ilmu Pendidikan Universitas Negeri Malang. Tidak dipublikasikan.
- [19] Sajan, K.S. (2010). *Teaching aptitude of student teachers and their academic achievements at graduate level*. (<http://files.eric.ed.gov/fulltext/ED508977.pdf>), retrieved on May 23, 2013.
- [20] Shukla, S.S. (2010). Study of the professional aptitude of Igou teacher trainees. *International Research Journal*, 1(12), 64-66.
- [21] Tatsuoka, M.M. & Lohnes, P.R. (1988). *Multivariate analysis: techniques for educational and psychological research*. Second Edition. New York: Macmillan Publishing Company.
- [22] Ushakumari, M.B. (2011). *Relationship of teacher aptitude with academic achievement and certain psychological variables of primary teacher trainees of Kerala*. (<http://ir.inflibnet.ac.in:8080/jspui/bitstream/10603/1552/14/14synopsis.pdf>), retrieved on July 20, 2014.
- [23] World Bank & Ministry of Education and Culture RI. (2010). *Transforming Indonesia's teaching force volume I: executive summary*. Jakarta: The World Bank Office Jakarta & Ministry of Education and Culture RI.