APPLICATION OF PRINCIPAL COMPONENT ANALYSIS METHOD ON TUTOR PERFORMANCE ASSESSMENT INSTRUMENTS WITH JEFFREYS'S AMAZING STATISTICS PROGRAM FORMULA

Ahmad
Fakultas Ilmu Pendidikan
Universitas Negeri Malang,
Indonesia

Address for Correspondence:
Jl. Semarang 5 Malang, Kota Malang, Indonesia
Email: ahmad.fip@um.ac.id

ABSTRACT

Producing tutor performance appraisal instruments is a practical step to improve the quality of human resources and the quality of non-formal education units. This instrument development research aims to produce a standard instrument for assessing tutor performance by involving 250 tutors as respondents when conducting an empirical test by filling in 33 questions representing 11 variables. Data on instrument filling was then analyzed using the formula of Jeffreys's Amazing Statistics Program (JASP) version 16.3. After the instrument met the requirements of factor analysis, an analysis was carried out using the PCA method the results in general the tutor performance assessment instrument had formed eleven main components with various sub-variables of each component such as seven sub-variables, three sub-variables, two sub-variables and one sub variable with matrix values. high correlation, so that the tutor's performance assessment instrument is suitable to be used to assess the tutor's performance.

Keywords: Assessment, Tutor Performance, Non-Formal Education, PCA

INTRODUCTION

Non-formal unit educators hereinafter referred to as tutors, not only carry out the function of transferring knowledge to students but also function to instill values and build student character on an ongoing basis. A tutor is a professional position that has the main task in the learning process (Undang-Undang Republik Indonesia Nomor 14 Tahun 2005 Tentang Guru Dan Dosen, 2005) Therefore, as a profession, a tutor must meet the minimum requirements including (1) Recruited from superior seeds from various potentials, (2) Educated well so that they master all competencies, not only have professional competence, but also master other competencies (pedagogic, social, and personality), (3) Having good motivation, educating is a call to the soul, and in its implementation using the 'heart', not only fulfilling the number of teaching hours and not only delivering standardized material, (4) Equipped with good and adequate facilities and infrastructure (Ahmad; Faisal Madani; M. Ishaq; Lasi Purwito; Ratih Permata Sari., 2022) (Siswantari, 2011)

To find out, if the tutor has worked well, then an assessment is carried out periodically with a good assessment tool. One of the indicators of the assessment is that it can be seen from the suitability of the process with what is planned, the suitability of achieving goals through good management, effective and efficient use and utilization of resources, as well as the ability to guarantee the suitability of the process and the achievement of goals.

Tutor performance assessment is a systematic step that assesses the real work of the tutor's work and behavior in realizing Pancasila-cultured students based on predetermined standards (The American Educational Research Association, the American Psychological

Association, 2014) (Chirchir & Letangule, 2021)(Atieno Otieno et al., 2021). The indicators used in the development of the tutor's performance appraisal model are divided into pedagogic, professional, social, and personality competencies. Tutor performance appraisal activities are not only seen from cognitive mastery as measured by test formulations,(Chanda Sichinsambwe, Lilian Lialabi, Alexina Muyenga, 2021) but more on the assessment of affective and psychomotor aspects is also a concern, to get the full profile of the tutor.

Tutors as professionals must meet standards by their expertise, skills, skills from an ethical point of view, and work ethic. On that basis, the work must be relevant to the duties of the profession. Discussions related to professional tutors are generally defined into two parts, namely: (1) A person who holds a profession. This means that professional tutors are identified as those who work according to their expertise and devote themselves to those who need expertise, and (2) In the form of tutor performance in completing work by professional assignments.

Tutor performance assessment is a continuous effort made to determine what is being carried out by monitoring the results achieved and if there are deviations from the predetermined criteria, an improvement is immediately made, so that all the results achieved can be as planned. Tutors not only carry out the function of transferring knowledge but also function to instill values and build the character of students in a sustainable manner. (Darling-hammond et al., 2017) but social reality shows that there are still many tutors who have not performed optimally. One of the causes of this problem is that not all non-formal institutions fully have home-based tutors while working tutors are resources who devote themselves voluntarily and not permanently. In general, those who become tutors get additional assignments and even side jobs from their main job. This is a serious phenomenon in staffing in non-formal units. Indeed, as a tutor, they must carry out their duties in totality so that they can shape the character of Indonesian children with Pancasila culture.

Tutor performance can be measured by learning planning, learning management procedures, the ability to build social relations in learning, the ability to evaluate, and the ability to complete non-academic tasks. (Direktorat Tenaga Kependidikan Ditjen PMPTK Depdiknas., 2008)(Besim Enes Bicak, Cornelia Eleonore Borchert and Kerstin Höner., 2021)(Atieno Otieno et al., 2021). With these indicators, at least the tutor in carrying out his duties as a learning facilitator who inspires students is not oriented to the function of the learning material provider, to create student creativity. This is what is expected in the context of independent learning where the absolute requirement of performance is the adaptation and high competence of a tutor. To carry out the adaptation process, a tutor must deeply understand the characteristics of students to have life skills and work skills. In addition, tutors must also be creative learners, able to teach, educate, inspire and be role models for students and society in general. Meanwhile, from the aspect of competence, tutors must be able to teach students to have numeracy literacy skills, science, information, finance, culture, and citizenship, be able to think critically, reason, be creative, be able to communicate, be able to collaborate, and have skills in problem-solving.

So, tutors in the era of disruption must be the drivers of change by transforming knowledge, skills, and attitudes centered on students who are independent in learning, able to innovate and all learning processes contribute greatly to learning change for learning citizens. Therefore, it is possible to measure the performance of tutors in non-formal education units differently from the point of view of the context, input, process, output, and impact. However, these differences, it becomes their strength in developing a standardized tutor performance appraisal model.

To measure the performance of tutors, a performance appraisal instrument based on pedagogic, personality, professional and social, technology and information, and literacy was developed. The dimensions of assessing the tutor's performance require an objective

refresher to produce an instrument that meets high validity and reliability. If the instrument meets these requirements, a needs analysis is carried out by the unit manager. Then, the head of the unit recommends the tutor to do a self-assessment and recommends other tutors to do a performance appraisal of the tutor being assessed. The results of the assessment are accumulated with the results of the observer and panelist assessments, to obtain recommendations for the results of the tutor's performance assessment so that it is useful for the self-development of tutors and non-formal education units. For the record, the team of observers and panelists is the element in charge of assessing the performance of tutors in non-formal education units, this can come from the leadership or other resources that are considered to meet the criteria that have been set.

Research has been done on the professional competence profile of tutors in Java, the results of the study show that the teaching and researching competence of a tutor is still not optimal so it needs to be improved, besides the problem of tutor competence still needs to be improved in supporting tasks in daily life. (Rahmat et al., 2021). Ten years ago, a study was conducted that the competence of tutors was low, one of the causes was the low understanding of the community regarding non-formal education (Siswantari., 2011) The results of other studies show that from the aspect of tutor competence, they are categorized as quite good. (Moh Muzaqi. Dwi Sudarmanto. Widya Ayu P.Yuni Ekawati., 2008). Based on the results of the study, in general, the performance of tutors is still low, so it is necessary to carry out periodic assessments to formulate competency improvement policies. The novelty of this research compared to other previous studies is to try to develop a tutor performance assessment instrument that is formulated into various complementary components in assessing the tutor's profile, so that the quality picture according to the competency standards set can be fulfilled optimally. Therefore, it is important to conduct this research to provide solutions to improve the quality of tutors so that the demands of work ethic and work ethic are well met. To produce a tutor's performance appraisal instrument, this study uses the Principal Component Analysis (PCA) method, which is a technique for reducing various dimensions to form new variables.(Zarachoff et al., 2022)(Jansson et al., 2022) The way it works is to determine the concept of eigenvalues and eigenvectors through the calculation of variance and principal components. PCA has benefits such as being able to overcome multicollinearity, reducing variables into models, practically limited variables forming simple models, and speeding up the computational process. So by using the PCA model, it can illustrate that the tutor's performance assessment instrument can be developed and has a high standard.

METHOD

This research on the development of the tutor's performance appraisal instrument is intended to produce a tutor's performance appraisal instrument that is obtained based on an empirical process through several tests. The standard instrument is a measuring instrument compiled by experts, always being tested, analyzed, and revised. (Aiken, 2020)(Gronlund, 1998) The development of standardized instruments is practically carried out in the following stages: (1) Identification of the underlying philosophy as a guide for the development process, (2) Developing basic theories, (3) Planning of prototype models by conducting a meta-analysis of theories, and (4) Validating by trying and revise one or more of the assessments.(Yalow & Popham, 1983)(Popham, 2016)

This study involved 250 tutors who worked in non-formal education units in East Java and involved 5 expert panelists/validators in the field of measurement. (Crocker, Linda, Algina, 1986)(Crocker & Algina, 1986a)(Tanujaya et al., 2017)(Popham, 1999) The stages of this research include (1) Observation and interviews with tutors and directly compiling the initial product, (2) Conducting construct tests and empirical tests to obtain valid and reliable final

instruments, and (3) Implementation of the results of assessment instruments the performance of non-formal education unit tutors. The criteria for the tutor's performance assessment instrument must meet the following requirements: (1) Can be generalized, (2) By actual conditions, (3) Measure more than one output, (4) Can be taught, (5) Objective, (6) Can be implemented realistically, and (7) Can be scored accurately. (Popham, 2009)(Popham, 2004)(Popham, 2014)(Crocker & Algina, 1986b)(Crocker & Algina, 1986a)(Crocker, Linda, Algina, 1986) To produce a standard instrument, the data from the experimental construct as well as empirically, then analyzed by factorial analysis technique using the formula Jeffreys's Amazing Statistics Program (JASP) version 16.3.(Pasaribu et al., 2021)(Zulfachri, 2021)

RESULTS AND DISCUSSION

Before discussing the results of the study, it is necessary to explain that the research instrument has been carried out with empirical tests involving 250 respondents to respond to 33 questionnaires divided into 11 dimensions of tutor performance assessment. The 250 people are all tutors who are and work at the Community Learning Activity Center and the Non-formal Education Unit of the Community Learning Activity Center in East Java. Factor analysis in this study uses Principal Component Analysis (PCA). The results of this study are as follows.

Factor analysis using PCA is a more concise analytical technique so that it quickly reduces the results of item analysis without losing the information contained in the original/initial data. PCA steps include selection and measurement of variables, preparation of correlation matrix, extraction of factors from correlation matrix, and rotation of factors to improve interpretation and interpretation of results. The results of the chi-squared test show that the tutor's performance instrument items have formed a varied model, where the p-value <.001 means that there are variations in the instrument items presented as shown in the following table.

Table 1. Chi-squared Test

	Value	df	p
Model	13750.071	220	< .001

Because the data assumption is that there is a fairly strong influence between the existing variations, this result is relevant to the loading factor value of the instrument items as follows.

Table. 2 Component Loadings

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	Uniqueness
F2	0.755											0.228
F3	0.707											0.309
E2	0.563											0.452
E1	0.552											0.400
E3	0.549											0.401
F1	0.539											0.460
D2	0.522											0.375
H2		0.670										0.420
I2		0.618										0.350
J2		0.539										0.376
G2			0.909									0.052
K1			0.909									0.052
K3				0.909								0.020
H1				0.909								0.020
K2					0.823							0.068
G3					0.823							0.068
A3						0.757						0.290
B2						0.655						0.340
A2						0.578						0.469

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	Uniqueness
J3							0.810					0.249
J1							0.744					0.314
C2								0.679				0.276
C3								0.626				0.383
A1								0.547				0.323
C1									0.815			0.233
B3									0.783			0.240
D3										0.834		0.197
G1											0.798	0.259
B1											0.512	0.369
D1												0.378
H3												0.352
I1												0.394
I3												0.451

Note. The applied rotation method is varimax.

The concentration of factors or commonly referred to as factor loading on the developed tutor performance assessment instrument has fulfilled 11 main components with an average value of factor loading between cells/factors above 0.5 as the lower limit/standard criteria. This shows that the main components of the item factors of the instrument used are feasible to be used as standard instruments in this study. This can be explained by the specific characteristics of the factor with the high characteristic eigenvalue of a vector/cell. The lambda value or eigenvalue of the three components is positive, meaning that there is an influence of an item on the formation of the matrix from factor analysis. Descriptively presented as follows.

Table 3. Component Characteristics

	Unrotated solution			Rotated solution		
	Eigenvalue	Proportion var.	Cumulative	SumSq. Loadings	Proportion var.	Cumulative
Component 1	10.066	0.305	0.305	3.693	0.112	0.112
Component 2	2.576	0.078	0.383	2.662	0.081	0.193
Component 3	2.033	0.062	0.445	2.404	0.073	0.265
Component 4	1.500	0.045	0.490	2.136	0.065	0.330
Component 5	1.301	0.039	0.530	2.080	0.063	0.393
Component 6	1.161	0.035	0.565	2.056	0.062	0.455
Component 7	1.122	0.034	0.599	2.047	0.062	0.518
Component 8	1.022	0.031	0.630	1.854	0.056	0.574
Component 9	0.962	0.029	0.659	1.760	0.053	0.627
Component 10	0.858	0.026	0.685	1.409	0.043	0.670
Component 11	0.834	0.025	0.710	1.334	0.040	0.710

Based on the results of the principal factor loading on the results of the 33-item empirical test filled in by 250 respondents, it can be described as the following sree plot.

Scree plot
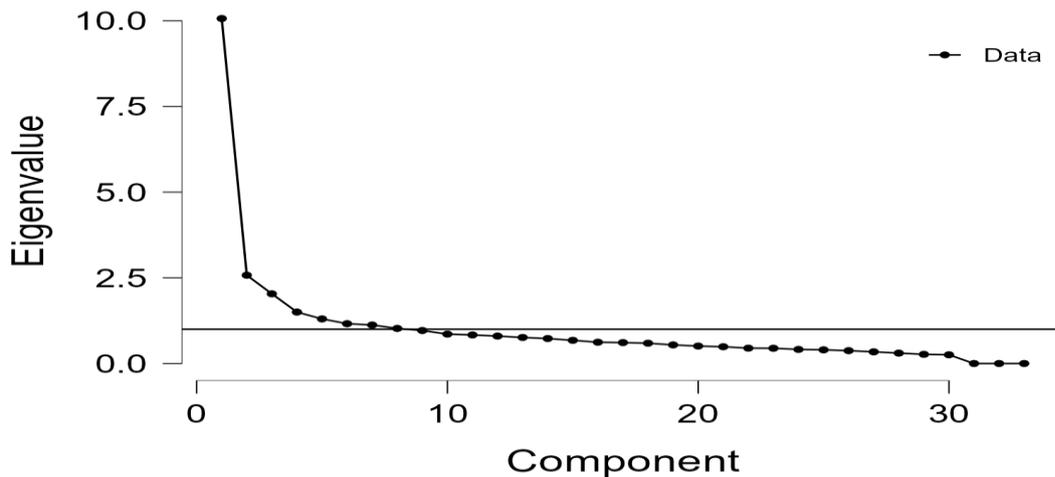
Referring to the results of the PCA analysis for the eleven components that measure the tutor's performance appraisal variable, empirically the instrument can be used to measure the quality of tutors. However, this result requires adjustments between items. This is due to the unequal distribution of grains in each of the existing components. In this discussion, it is necessary to re-explain the eleven components formed in the research, including Mastery of technology and information (PC1), Skills in writing scientific papers (PC2), Mastering literacy and numeracy (PC3), Management of learning time (PC4), Management of student behavior (PC5), Presentation of learning (PC6), Monitoring of Learning (PC7), Feedback in learning (PC8), Facilitating learning (PC9), Effective communication (PC10), and Additional tasks (PC11). The explanation of each of these components is as follows:

1. PC1 with the highest eigenvalue of 10,066 with its seven sub-variables has a characteristic high correlation matrix value.
2. PC2, PC6, and PC8 with high eigenvalues and three sub-variables with high correlation matrix values.
3. PC3, PC4, PC5, PC7, PC9, and PC11 on average have two sub-variables that are part of each group with high eigenvalues and correlation matrix.
4. PC10 with an eigenvalue of 0.858 has one sub-variable with a high correlation matrix value.

So, each component has various sub-variable characteristics, so that it can reduce variables and form the main variable. PCA can reduce data easily to simplify the observed variables by shrinking their dimensions.(Fenyvesi & Horváth, 2022)(Badri & Sari, 2021)(Wangge, 2021) This step is done to eliminate the correlation between variables by forming new sub-variables.

CONCLUSION

Based on the results of research using factor analysis using the PCA method, it is concluded that the tutor's performance assessment instrument has formed eleven main components with various sub-variables of each component such as seven sub-variables, three sub-variables, two sub-variables, and one sub-variable with a high correlation matrix value so that the tutor's performance assessment instrument can be declared to have a high level of validity and reliability so that it is appropriate to be used to assess the tutor's performance.

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