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Exploratory Factor Analysis of *Teacher's Engagement Scale for Early Child Teacher*

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Abstract

Teacher engagement is an important factor for teachers to have, which can influence student engagement and student success in the educational process at school. Teacher engagement in this research comes from the student engagement construct, including definitions of behavioral engagement, emotional engagement, and cognitive engagement. This research aims to explore the initial development of the Teacher Engagement Scale specifically for early childhood teachers. This research uses exploratory factor analysis (EFA) method, to see whether the Teacher Engagement Scale items can reflect the construct of teacher engagement. The participants in this research were early childhood teachers with a minimum of 1 year teaching experience. There would be around 230 -245 participants to be involved in this research. The measurement method uses self-report with 4 Likert scales. There are 23 question items in this questionnaire. EFA in this research produces two factors that can explain the construct of teacher engagement. EFA also found that the items from the emotional dimension may not represent that dimension.

Keyword : Teacher Engagement Scale, early child teacher, teacher engagement, Exploratory Factor Analysis

Abstrak

Teacher engagement atau keterlibatan guru menjadi salah satu faktor penting untuk dimiliki guru, yang dapat mempengaruhi student engagement dan keberhasilan siswa dalam proses pendidikannya di sekolah. Teacher engagement dalam penelitian ini berasal dari konstruk student engagement, meliputi definisi dari behavioral engagement, emotional engagement, serta cognitive engagement. Penelitian ini bertujuan untuk mengeksplorasi pengembangan awal dari Teacher Engagement Scale yang dikhususkan untuk guru anak usia dini. Metode penelitian ini menggunakan analisis faktor eksploratori atau Exploratory Factor Analysis (EFA), sehingga dapat diketahui apakah aitem-aitem Teacher Engagement Scale tersebut dapat mencerminkan konstruk teacher engagement. Partisipan dari penelitian ini adalah guru anak usia dini dengan lama mengajar minimal 1 tahun dan berjumlah sekitar 230 -245 orang. Metode pengukuran menggunakan self-report dengan 4 skala Likert. Total aitem pertanyaan dalam kuisioner ini berjumlah 23 buah. EFA pada penelitan ini menghasilkan dua faktor yang dapat menjelaskan konstruk dari teacher engagement tersebut. EFA juga menemukan bahwa aitem-aitem dari dimensi emosional kemungkinan belum mewakili dimensi tersebut.

***Kata Kunci** : Teacher Engagement Scale, Guru Anak Usia Dini, Engagement Guru, Analisis Faktor Eksploratori*

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BACKGROUND

As the Covid-19 pandemic ends, the education field in Indonesia is also experiencing changes, one of the changes is the learning procedures in Early Childhood Education (PAUD). Since the 2022/2023 academic year, based on the 4th Ministerial Decree (Kemdikbud, 2022), education at all levels has changed all learning types again, both Distance Learning (PJJ) and hybrid, into one hundred percent Face-to-Face Learning (PTM). These changes have given new challenges for education field in Indonesia, especially for students and teachers who are the main part of the success of the learning process in the classroom. In PAUD, changes to the learning process also require greater time and effort due to the young age of the students (Faturohman & Gunawan, 2021), especially to change learning habits that have previously been carried out online and also an adaptation process for new students. first time attending school.

The challenge for teachers during the face-to-face learning process is how to find strategies that support students so they can have active involvement in school (Pedler et al., 2020). This is in line with Faturohman and Gunawan (2021) that teachers play a role in increasing students' interest in learning by planning interesting learning activities and learning innovations. Pedler et al. (2020) states that various literature emphasizes that student involvement in school can become more meaningful because of the role of teachers in school. Meanwhile, Hapsari et al. (2020) stated that a close teacher-student relationship can improve children's abilities, including early childhood literacy abilities. Teachers who strive to create a warm closeness in guiding their students also tend to have higher levels of well-being and lower levels of stress and fatigue (Jennings & Greenberg, 2009).

However, there are other challenges that schools must face to respond to the change in learning to face-to-face learning, such as the attitude of early childhood teachers who are less progressive and adaptive and maintain the methods they have used for years (Hidayat & Nisa, 2022). The educational background of teachers in PAUD which is not linear with their work as teachers in PAUD is also a challenge in creating active student involvement in the classroom (Sa'diyah et al., 2022).

Engagement, Student Engagement and *Teacher Engagement*

Engagement is defined as a construct that covers goals which are guided by human behavior, thoughts and feelings (Fredricks et al., 2004). Meanwhile, student engagement refers to how students behave towards school and student participation in school (Willms, 2003). Student engagement has become the focus of many studies because it has the potential to overcome the problems of student boredom, low achievement, and high school dropout rates (Wang & Degol, 2014).

Student involvement in classroom learning allows students to put their focus and energy on completing assignments, show resilience when tasks are difficult, and maintain mutually supportive relationships with teachers and peers, as well as having a relationship with their school (Wang & Eccles, 2012a; 2012b). Students can be more engaged behaviorally and cognitively during school learning if teachers provide clear expectations and instructions, with strong guidance and constructive responses (Jang et al., 2010).

Teacher engagement is defined as a motivational construct that describes the voluntary allocation of resources and energy in teaching activities (Klassen et al., 2012). Numerous existing measuring tools for teacher engagement include the Engaged Teacher Scale (ETS) described by Klassen et al. (2013). This ETS takes teacher engagement from the work engagement aspect. Another measuring tool is the Teacher Engagement Index (ITEI) which measures teacher capacity in terms of pedagogical, personality, social and professional preschool teachers (Sasmoko et al., 2017). ETS and ITEI measure teacher engagement from the professional aspect of a teacher.

Teacher engagement in this research comes from the student engagement construct Fredricks et al. (2004), including definitions of behavioral engagement, emotional engagement, and cognitive engagement. Behavioral engagement includes the willingness to do work and follow the rules. Emotional engagement includes self-interest, values, and emotions. Meanwhile, cognitive engagement includes motivation, effort, and strategy (Fredricks et al., 2004).

The Teacher Engagement Scale was being developed in terms of finding out how engaged teachers from early childhood are, which can make student involvement in school more meaningful. The aim of this research is to explore the initial development of the Teacher Engagement Scale specifically for early childhood teachers, by conducting exploratory factor analysis, based on a representative sample in Indonesia.

Exploratory Factor Analysis (EFA)

To find out whether the Teacher Engagement Scale can obtain accurate data based on its objectives, a validation process is needed to prove it , one of which is using factor analysis. Factor analysis serves to reduce variables into smaller sets, establish measured dimensions and latent constructs, as well as build and refine theories, and provide evidence of construct validity on self-report scales (Williams et al., 2010). This research uses exploratory factor analysis (EFA). Exploratory factor analysis is a multivariate statistical method that identifies hypothetical constructs (also called dimensions, latent variables, factors, synthetic variables/internal attributes) from the smallest ones, and also limitedly discusses the covariation of variables that can be measured (Watkins, 2018). Meanwhile, according to Izquierdo et al. (2014), the use of EFA aims to obtain the minimum number of factors that can be used to produce a matrix of item correlations.

The use of exploratory factor analysis according to Thomson (2004) in Williams et al. (2010) are (1) reducing the number of variables, (2) studying the structure/relationship between variables, (3) detecting and assessing the unidimensionality of theoretical constructs, (4) assessing the

construct validity of scales, tests, or instruments, (5) developing analysis and simple interpretation, (6) overcoming multicollinearity (two or more correlated variables), (7) for developing theoretical constructions, and (8) for proving the proposed theory.

The following are the steps in applying exploratory factor analysis, namely the first step, evaluating whether the data is suitable for using EFA. The second step is to determine the factor extraction method. Third, use a method to select retained factors. The fourth step is choosing a rotation method and the fifth step is interpreting the results of the previous steps (Taherdoost et al., 2022).

RESEARCH METHODS

Research Type and Design

This research is quantitative research that carries out correlational research and collects cross-sectional data using a survey method that distributes questionnaires to research subjects.

Data Measure and Collection Method

The measurement method uses self-report with a Likert scale. The total number of question items in this questionnaire is 23. These items are an explanation of the teacher engagement construct from Fredricks et al.'s (2004) student engagement theory, which consists of 3 dimensions: behavioral engagement, emotional engagement, and cognitive engagement.

Participants in this research were obtained through convenient sampling which included teachers from early childhood education or kindergartens in Indonesia. Data is measured based on a Likert scale with a scale of 1 to 4 with criteria namely (1) Strongly Disagree; (2) Disagree; (3) Agree; and (3) Strongly Agree.

Research Participants

The 230-245 participants for this research participants (for the exploratory factor analysis stage) in order to fulfill the requirements for data processing using factor analysis procedures using guidelines from psychometric experts, such as the number of items multiplied by 10 or 15. Hair et al. (1998) in Rahim and Saputra (2018) stated that factor analysis can be carried out with a sample size of at least five times the number of variables in the questionnaire. Specific participant population criteria, namely (a). early childhood teacher (with student ages ranging from 4-6 years); (b). have at least 1 year teaching experience.

Data Analysis Method

This research is going to prove construct validity using exploratory factor analysis, with data processing using licensed STATA version 13 software. Researchers used Google Form to gather the data. The researcher will distribute the link to people known to the researcher and who meet the criteria explained above and use social media to disseminate information about the survey via the WhatsApp application and electronic mail. Data collection is carried out for approximately 2 (two) weeks and will be closed if the number of respondents has met the target number, namely: the number of participants is around 230 - 345 people (for the exploratory factor analysis stage).

RESEARCH RESULTS

Based on the data analysis from the Teacher Engagement Scale, a preliminary test was carried out to find out whether this measuring tool could be analyzed using exploratory factor analysis (EFA). The first step of EFA is to compile a correlation matrix by looking for matrix correlations between the observed indicators. The Bartlett test and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test were carried out to determine the adequacy of sampling both overall and for each indicator.

The EFA step begins with data filtering using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (> 0.5) and Bartlett's Test of Sphericity (Taherdoost et al., 2022). Principal Components Analysis (PCA) is used to obtain a number of factors that will be retained, from data that includes 23 items and a calculated sample size of 249 and considers factors that have an eigenvalue > 1 (Wood et al., 2015). Based on the Bartlett's Test, it was found that the existing data met the assumptions ($\chi 2 = 2270.538$; $p<0.05$), which showed a significant correlation ($p<0.05$) between the observed variables, so that factor analysis on this measuring instrument could be carried out.

Meanwhile, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test result from this measuring instrument is 0.86. This means that this data has an adequate sample, overall, it is in the good category and factor analysis can be carried out because it has results > 0.5. The KMO index value of the 23 items of the Teacher Engagement Scale also shows that the sample size used is adequate (Shrestha, 2021). After the requirements to be able to carry out exploratory factor analysis are met, data processing on the Teacher Engagement Scale can be continued.

The second step of EFA is factor extraction. The aim of factor extraction is to obtain the right number of factors to explain teacher engagement. Factor extraction is a method of reducing data from several indicators so that fewer factors are produced that can explain the correlation between observed indicators (Erlanggashani et al., 2022). Factor extraction in this research uses several methods, including Principal Components Analysis (PCA), Parallel Analysis (PA), Minimum Average Partial Correlation (MINAP), and Maximum Likelihood (ML).

Principal Components Analysis (PCA) is used to reduce the dimensions of a data set with a tendency to maintain meaningful information on the initial axis (Caron, 2019). Factor extraction with PCA uses total variance which includes common variance, specific variance and error variance, reducing specific and error variance as small as possible (Abdal et al., 2023). Velicer, Eaton and Fava (2000) stated that Parallel Analysis (PA) and Minimum Average Partial Correlation (MINAP) have accurate results in terms of loading so that the correlation matrix formed between components tends to be similar, with a loading factor > 0.50 and a total of variables that are relatively the same in each component.

EFA also uses the maximum likelihood method because this method can estimate important quantities efficiently, which are functions of data and parameters without being directly related to the parameters. This method can produce parameter estimates that are more likely to produce an observation correlation matrix (Khusna et al., 2021).

In table 1 below, factor extraction was carried out using PCA and in the table it can be seen that all items are suitable for factor analysis because they have an anti-image correlation coefficient greater than 0.5.

Table 1. Extraction Factor Result using PCA

Principal components/correlation — Number of obs = 249; Number of comp. = 23; Trace = 23; Rho = 1.0000; Rotation: (unrotated = principal)

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	7.11128	4.9057	0.3092	0.3092
Comp2	2.20558	.64125	0.0959	0.4051
Comp3	1.56433	.332042	0.0680	0.4731
Comp4	1.23229	.177249	0.0536	0.5267
Comp5	1.05504	.0343313	0.0459	0.5725
Comp6	1.02071	.130037	0.0444	0.6169
Comp7	.890672	.0321309	0.0387	0.6556
Comp8	.858541	.0791641	0.0373	0.6930
Comp9	.779377	.0271927	0.0339	0.7269
Comp10	.752184	.0850734	0.0327	0.7596
Comp11	.667111	.0815503	0.0290	0.7886
Comp12	.585561	.00838361	0.0255	0.8140
Comp13	.577177	.00654656	0.0251	0.8391
Comp14	.57063	.105453	0.0248	0.8639
Comp15	.465178	.0275294	0.0202	0.8842
Comp16	.437648	.0220541	0.0190	0.9032
Comp17	.415594	.0234267	0.0181	0.9213
Comp18	.392167	.0116292	0.0171	0.9383
Comp19	.380538	.0359929	0.0165	0.9549
Comp20	.344545	.0361268	0.0150	0.9698
Comp21	.308419	.0330091	0.0134	0.9832
Comp22	.275409	.1654	0.0120	0.9952
Comp23	.11001	.	0.0048	1.0000

Looking into table 1 above, it can be seen that the results of PCA without rotation show that there are 6 factors that meet the requirements, because they have an eigenvalue >1. These six factors were able to explain the variance of the Teacher Engagement Scale factor of 61.69%.

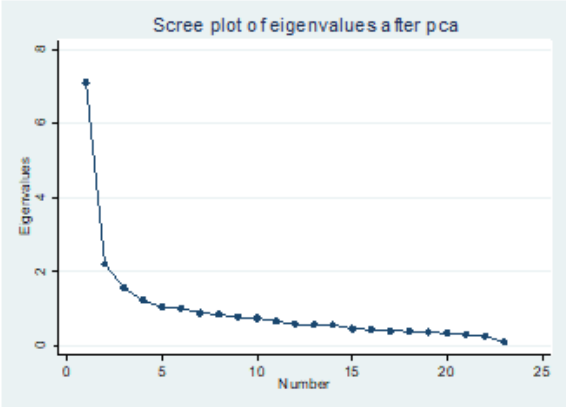

Figure 1: Scree Plot Factor Analysis with PCA

However, based on the Scree Plot above (figure 1), it can be seen that there are 2 (two) factors that have a value > 1 before the graph slopes. This is also supported by the results of extraction using the minimum average partial correlation (MINAP) procedure which suggests that there are 2 (two) principal components that must be extracted. The scree plot below (figure 2) also supports the results from MINAP above, that there are 2 (two) factors that appear to be above the PCA line which is starting to slope.

Since some of the factor extraction methods above do not obtain clear main factor components, factor rotation is necessary. This can be seen in the results of the PCA analysis in table 1 which still produces 6 factors, so factor rotation is needed to simplify the results of the exploratory factor analysis.

Factor rotation will help maximize loadings from high items and minimize loadings from low items. Factor rotation aims to obtain a factor structure that is easy to interpret because it is simpler. There are two rotation techniques, namely orthogonal rotation and oblique rotation (Hair et al., 2010).

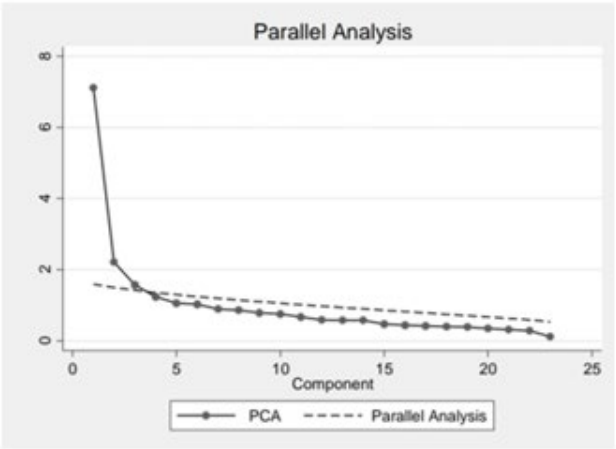

Figure 2: Scree Plot with PCA Method and Parallel Analysis

In EFA, orthogonal rotation is usually used because it produces uncorrelated factors so it is easier to interpret and the model is also simpler. Meanwhile, oblique rotation is carried out on correlated factors. This oblique rotation is suitable for research in the social sciences, such as psychology, where the factors of the construct are correlated with each other (Osborne, 2015). Factor rotation is also carried out so that the interpretation of data resulting from factor analysis can be clearer

If there are variables that are not significantly different from other variables or have a factor loading < 0.5, then factor rotation needs to be carried out. The position of these variables in the factors can also be clarified by factor rotation (Khusna et al., 2021).

In this exploratory factor analysis research, oblique promax rotation is used, because this research is psychological research in which the factors are correlated with each other to develop constructs from the measuring instrument.

Table 2. Analysis Factor using Principal Factor Method with Oblique Promax Rotation

```
. rotate, promax oblique kaiser

Factor analysis/correlation                    Number of obs    =      249
    Method: principal factors                  Retained factors =        2
    Rotation: oblique promax (Kaiser on)       Number of params =       45
-------------------------------------------------------------------------------
        Factor  |   Variance   Proportion  Rotated factors are correlated
----------------+--------------------------------------------------------------
       Factor1  |    5.23865       0.5109
       Factor2  |    5.18930       0.5061
-------------------------------------------------------------------------------
LR test: independent vs. saturated: chi2(253) = 2280.02 Prob>chi2 = 0.0000
```

In table 2, factor analysis/correlation is carried out using the principal factors method and oblique promax rotation with table 3 describing the factor loadings of the items. Apart from that, it was also found that there was a correlation of 0.84 between factor 1 and factor 2. This indicates that these two factors, the behavioral factors and cognitive factors, are factors that measure the construct of teacher engagement.

From the results of exploratory factor analysis using the principal factor method with oblique promax rotation (table 2), two (2) factors were obtained with variance >1. From the results of exploratory factor analysis using the

Meanwhile, in table 3, you can see the factor loadings from the results of factor analysis in table 2, which can distribute the loadings of each item so that there is a mutual correlation between the two factors. Factor loading can present the correlation between variables and their factors (Hair et al., 2010). Researchers do not use items with factor loadings below 0.3 (table 3).

Tabel 3. Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
b1	-	0.4489	0.7569
b2	-	0.5372	0.6289
b3	0.3186	0.4076	0.6225
b4	-	0.4973	0.5865
b5	-	0.9350	0.2339
b6	-	0.9441	0.2343
b7	-	0.6752	0.5536
e1	-	0.4708	0.5943
e2	0.3298	0.3850	0.6356
e3	-	-	0.9809
e4	0.3659	-	0.7261
e5	0.3008	-	0.7714
e6	-	0.3192	0.8547
e7	-	-	0.9396
e8	0.4335	-	0.6846
c1	0.6593	-	0.5007
c2	0.6742	-	0.5123
c3	0.6678	-	0.5045
c4	-	-	0.9465
c5	0.5834	-	0.6296
c6	0.6119	-	0.5880
c7	0.6572	-	0.5718
c8	0.6696	-	0.5510

b : factor behavior engagement; c : factor cognitive engagement; dan e : emotional engagement.

Tabel 4. Loading Items from *Teacher Engagement Construct*

	Factor 1		Factor 2
e4	I feel happy when teaching	b1	I carry out daily teaching activities according to the plan
e5	I enjoy joking with students	b2	I apply fair class rules to all students
e8	My students love to tell me about their experiences	b3	I recognize the problems students face
c1	The tools and teaching materials that I use are liked by the students	b4	I accompany students to overcome the problems they face
c2	The students were interested in the activities that I had prepared	b5	I use the word help when asking for help from each student
c3	I ask 'what', 'why' and 'how' questions to students when learning	b6	I express my gratitude when receiving help from students
c5	I provide a variety of activities for students to choose from	b7	I appreciate it when students help their friends
c6	I encourage each student to play an active role in their group	e1	I understand when students are sad/happy/angry/scared
c7	I ensure that learning activities relate to students' daily lives	e2	I give students the opportunity to express their opinions
c8	I provide specific feedback on the work students do	e6	Students who do not follow activities according to procedures make me give up

b : factor behavior engagement; c : factor cognitive engagement; and e : emotional engagement.

DISCUSSION

Exploratory factor analysis (EFA) in this research aims to develop an initial scale, namely to determine the number of factors that can explain the construct of the Teacher Engagement measuring tool.

This measuring tool was developed based on the construct of student involvement from the theory of Fredricks et al. (2004), which has three dimensions, namely behavioral engagement, emotional engagement, and cognitive engagement.

The measurement results show that the reliability of the Teacher's Engagement measuring instrument is that the reliability for the behavioral engagement alpha dimension is 0.84 and the cognitive engagement alpha dimension is 0.81. This result is in accordance with the opinion of Taber (2018) who states that all consistency test results are reliable in the range of 0.84–0.90. In the emotional dimension of involvement with an alpha of 0.63, this dimension shows that it is less reliable, because the value is below 0.84.

The reliability results above support the results of the exploratory factor analysis carried out on this measuring instrument, namely that two factors or dimensions (cognitive engagement and behavioral engagement) were obtained which can explain the construct of teacher's engagement. The existence of a correlation between the dimensions of cognitive engagement and behavioral engagement analysis on these factors also shows that both are constructs of teacher engagement. Meanwhile, for the emotional engagement factor, which can be seen in table 4, it was found that the items of emotional engagement were spread across cognitive engagement and behavioral engagement, so that there was no clear concept of this construct.

Several previous studies have also explained three dimensions of engagement, which consist of the three main dimensions of cognitive engagement, emotional engagement, and behavioral engagement (Appleton et al., 2006; Jimerson et al., 2003; Ladd & Dinella, 2009). However, unclear concepts related to the emotional dimension (emotional engagement) also occur and result in this dimension appearing to receive less attention when compared to the other two dimensions (cognitive engagement and behavioral engagement) (Fredricks et al., 2004). One of them is in a study from Appleton et al. (2006) who call this dimension of emotional engagement of psychological involvement.

In the study, Ladd & Dinella (2009) found that indicators of emotional engagement were not good because they were often combined with two other dimensions (cognitive engagement and behavioral engagement), so researchers had difficulty isolating their predictive contribution to explaining the construct.

In Sagayadevan & Jeyaraj's (2012) research on emotional engagement, it is proven that this dimension is included in the construct of engagement, and is important for children's achievement at school. Therefore, efforts are needed to obtain conceptually clearer items to explain the construct of the emotional engagement dimension, so that this dimension can become part of the main component of the teacher engagement construct.

CONCLUSION AND SUGGESTION

From the exploratory factor analysis (EFA) carried out on the Teacher's Engagement measuring tool, it can be concluded that for the purpose of initial scale development, this analysis produces two factors that can explain the variables of this measuring tool. Based on the results of exploratory factor analysis (EFA), factor 1 was obtained which reflects the cognitive engagement dimension and factor 2 is the behavioral engagement dimension. These two factors are correlated with each other and together can measure the construct of teacher's engagement. This is different from the theory of Fredricks et al. (2004) which is the basis for the construction of this Teacher's Engagement measuring tool. In this theory there are three dimensions, including behavioral engagement, emotional engagement, and cognitive engagement.

The items we created for the emotional dimension of the Teacher's Engagement measuring tool may not represent that dimension. Therefore, we recommend re-creating the items for the emotional engagement dimension so that they can better reflect the emotional engagement dimension. The conceptual clarity of emotional engagement also needs to be paid more attention, to make it easier to create indicators so that they can better explain the teacher's engagement construct and become the main component of this construct.

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