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The Development of an Instrument for Assessing Students' Perceptions of Physics Teachers' Approaches to Teaching

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Abstract

This study describes the development of an instrument to evaluate students' perceptions of physics teachers' approaches to teaching in Indonesian Senior High Schools in two categories namely, Teacher-Focused (TF) and Student-Focused (SF) scales. Students' Perceptions of Physics Teachers' Approaches to Teaching (SP_2TAT) questionnaire, consisting of 22 items, was administered to 612 senior high school students, who varied in grades, sex, and achievement level. Validity and reliability measures of the instrument were established based on factor analysis and Cronbach's alpha. The rotated factor matrix, using varimax rotation, supported the two-scale structure of the final version of the 14-item SP_2TAT questionnaire which had 0.6 and 0.7 of Cronbach's alpha values. These results confirmed that the instrument has statistical validity, satisfactory reliability, and a good factor structure. (123 words)

Keywords: students' perceptions, physics teachers, approaches to teaching

1. INTRODUCTION

Perception is a process which involves the recognition and interpretation of stimuli which register on our sense [1]. Perception is not just the passive receipt of the sensory information (for example, vision and hearing) but can be shaped by learning, memory, and expectation. Goldstein [2] stated that perceptions both create an experience of the environment and enable people to act within it. Students' perceptions of their physics teacher approaches to teaching should prove picture of how they perceive or view their teacher approaches to teaching.

2. THEORETICAL BACKGROUND

During the past ten years, some researchers (see for example: Trigwell and Prosser [3]) have developed teachers' approaches to teaching instruments. The instruments were validated using exploratory factor analysis (EFA) following by confirmatory factor analysis (CFA). The number of factors (scales) in the instruments varies from many factors to two factors. However, most instruments are based on the teachers' views. The instruments are suitable only to measure teachers' perceptions about their own approaches to teaching.

Teachers' approaches to teaching vary between two broad approaches – content-centred and learning-centred – and are characterised by a motivational component and a strategy component [4]. In other words, a key qualitative variation in approaches to teaching was between an information transmission/ teacher-focused approaches to teaching and a conceptual change/ student-focused approaches to teaching [3, 5].Item-item of questionnaire should support these two factors or scales and should measure students' perceptions of the physics teachers' approaches to teaching.

3. RESEACH PURPOSE

The purpose of the study was to develop an instrument (the SP_2TAT) that could be used to identify and evaluate students' perception of theirphysics teachers' approaches to teaching. Students are in a good position to form accurate impressions about theirphysics teachers' approaches

to teaching because they have encountered various learning environments during their studies. The development of an instrument for assessing students' perceptions of the physics teachers' approaches to teaching would be very useful for senior high school institutions.

4. METHOD

After the conceptual framework for the questionnaire was established, several issues were carefully considered:(1) as no existing suitable instrument was available to measure students' perceptions of physics teachers approaches to teaching in Indonesia, several items could be adopted or modified from various questionnaires; (2) the items should be easy to understand and do not have ambiguity; (3) each item should be meaningful from the students' perspectives.

Twelve items of SP_2TAT questionnaire were developed in each of the two scales/categories. Several items were developed by modifyingitems from questionnaires that have been used in various studies. Each of the items required respondents to make a selection on a 5-point Likert-type scale ranging from 1 for strongly disagree, 2 for disagree, 3 for not sure, 4 for agree, and 5 for strongly agree.

The instrument wasvalidated based on suggestions from some experienced physics teachers. These items were translated into Indonesian by the first author and back-translated into English by an Indonesian physics teacher without reference to the original items.The authors then compared and checked the meaning of the back-translation and the original instrument in order to decide whether or not any items needed to be revised.

Several items were modified in order to make them more meaningful and two items were deleted.Finally, 22 items were established in the SP_2TATquestionnaire in two scales – Teacher-Focused (TF) and Student-Focused (SF) scales.

The 22-item SP_2TAT questionnaire was pilot-tested by administering to 612 students from eleven senior high schools in Jambi (one of Indonesian provinces), who varied in grades, sex, and achievement level. Based on data analysis involving item-scale correlation and factor analysis, eight items were removed.All items which had item-scale correlation values higher than 0.4 and factor loadings 0.4 or above were retained.

The final version of the SP_2TAT questionnaire consisted of 14 items; a summary of the final version is provided in Table 1.

Table (1) Structure of the final version of the SP_2TAT questionnaire

Scale name	No. of items	Examples of items
Teacher-Focused (TF)	7	My physics teacher focus only on providing me with the information related to formal assessment (TF1).
		My physics teacher uses teaching methods with the assumption that most students have very little knowledge (TF3).
Student-Focused (SF)	7	My physics teacher's assessments encourage me to be a self-regulated learner (SF1)
		My physics teacher tries to make a discussion with students about the topics we are studying (SF2).

5. RESULTS AND DISCUSSION

Students' responsesto the 14 items of the instrument to evaluate their perceptions of the physics teachers' approaches to teachingwere analysed using SPSS (Version 19). The descriptive statistics (Table 2), factor analysis (Table 3), and reliabilities (Table 4) are provided below.

5.1 Descriptive statistics

In Table 2, the mean response for the TF scale (Teacher-Focused) was 3.78, indicating that respondents on average agreed with the teacher-focused approaches portrayed by the items.For the SFscale (Student-Focused), the mean response was 3.68indicating that respondents' perceptions of student-focused approaches that their teachers used ranged between 'not sure' and 'agree'.

Table(2) Descriptive statistics for the two scales of the SP_2TAT questionnaire to measure students' perceptions of physics teachers' approaches to teaching

Scale	No of items	Mean	Standard Deviation
TF	7	3.78	0.51
SF	7	3.68	0.58

5.2 Validity of the instrument

The rotated factor matrix, using varimax rotation, shown in Table 3 supports the two-scale structure of the SP_2TAT questionnaire based on the screeplot (Figure 1) as recommended by Catell[6] and described by[7]. Each factor contains high positive loadings on all seven items for the TF and SF scales. These results suggest that the questionnaire has statistical validity.

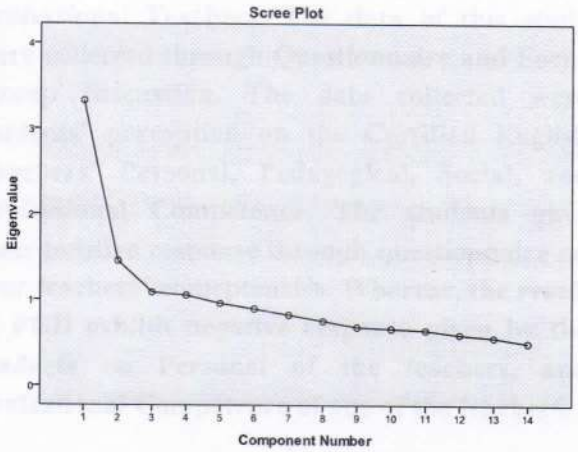

Figure 1 ScreePlot

Table (3) Factor Analysis of Items in Final Version of the SP_2TAT-survey

Item Number		*Factor*	
		Students-focused	*Teachers-focused*
1	(SF1)	0.58	
2	(SF2)	0.69	
3	(SF3)	0.69	
4	(SF4)	0.61	
5	(SF5)	0.48	
6	(SF8)	0.56	
7	(SF9)	0.50	
8	(TF1)		0.61
9	(TF2)		0.58
10	(TF3)		0.47
11	(TF4)		0.57
12	(TF8)		0.47
13	(TF10)		0.46
14	(TF11)		0.46
	Eigenvalue	3.33	1.46
	% Variance	23.76	10.39
	Cumulative % variance	23.76	34.15

Note. Loading less than 0.4 removed; eigen> 1.087 (based on scree plot); n = 612;
Extraction method: Principal components analysis;
Rotation methods: Varimax with Kaiser Normalization (KMO: 0.807)

5.3 Reliabilities

The scales for each category had high Cronbach's alpha values ranging from 0.71 and0.60(see Table 4), indicating that the scales was reliable measure ofstudent focused scale of the physics teacher approaches to teaching being investigated.DeVellis[8] states that, the Cronbach's alpha coefficient should ideally be above 0.7.

Table (4) Reliability of the SP_2TAT–survey

Scale	*No. of Items*	*Cronbach's alpha Reliability*
SF	7	0.71
TF	7	0.60

5.4 Conclusions

The data analysis indicated that the instrument on student perceptions of the physics teachers' approaches to teachingphysics have satisfactory validity and reliability measures.The

uniqueness of the SP_2TATquestionnaire is that it is specifically related to the experiential curriculum. This is important because the instrument has the potential to assist lecturers to identify pre-service teachers' and graduates' perceptions on their own physics teaching. By examining the results from administration of the instrument, researchers and teachers can recognise those aspects of the physics teachers' approaches to teaching that need to be improved.

To establish the instrument's usefulness, future research is required to provide in-depth information concerning students' perceptions of their teachers' approaches to teachingby conducting interviews.Also, further research needs to be conducted with a larger number of students and use CFA in analysing the instrument.

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