

Original Article

Developing a measurement tool of the effectiveness of the physical education teachers' teaching and learning process

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Abstract

One of the major hurdles in the physical education in Indonesia is the ineffectiveness of the teaching and learning process at school. This condition results from the limited ability of its teachers and the resources used to support their teaching and learning process, as well as the absence of the tool to measure their effectiveness in the teaching and learning processes. The purpose of this study is to develop a tool to measure the effectiveness of the physical education teachers' teaching and learning processes as a scoring scale. The subjects of this study are the physical education teachers and public senior high school students in Banda Aceh, Indonesia. Two processes are conducted to design the measurement tool of the effectiveness of physical education teachers' teaching and learning processes, namely: (1) item pool and (2) screening of item pool with Q-sort method. Then, the measurement tool was tested to 350 public senior high school students in Banda Aceh. The data was analyzed through the testing of validity and reliability, and factor analysis. The result of this study reveals that the measurement tool of the effectiveness scale of the physical education teachers' teaching and learning processes comprises seven dimensions and 60 statement items that are valid; they further have a high degree of validity with the index of 0.600 and a high level of reliability with the index of 0.740. These two indexes indicate that this tool can be used to measure the effectiveness of physical education teachers' teaching and learning processes.

Key Words: development, measurement tool, effectiveness, teachers' teaching and learning processes

Introduction

Physical education is considered a very important means for achieving social development in the modern communities (D'oum and Anannza, 2012).

In this globalization era, the tasks and roles of physical education teachers have become weightier. The teachers' readiness, mastery of their field of study, and responsibilities become the greatest asset to the realization of effective teaching and learning processes. Professional teachers are demanded to be ready and master either their field of study or the thorough design of their teaching and learning programs.

Apart from that, the dynamics of the students' learning and teachers' guidance are the result of the teaching and learning activity manifestations in the classroom. For this reason, it is undeniable that the teachers should possess the knowledge, ability, and skills in applying accurate teaching methodologies and approaches. The professional teachers' competence should be combined with their abilities to comprehend the students' dynamic behavior and development, considering that more and more problems are arising in the physical education field.

Mutohir (1996) explains the current hurdles concerning physical education in Indonesia, one of which is the ineffectiveness of teaching and learning process in this field. This condition results from the limited ability of physical education teachers and the resources used to support their teaching and learning process, as well as the absence of the tool to measure the effectiveness of their teaching and learning processes. Soemosasmito (1998) further asserts that until recently, there had not been a reliable research that could cope with the problems pertaining the teachers' effective teaching and learning process. Previously, there were some previous studies that aimed at figuring out the characteristics of teachers' effective personalities, but they have not used any instrument to measure their validity and reliability.

In relation to the aforementioned arguments, it can be concluded that to solve the problems on the effectiveness of physical education teachers' teaching and learning processes, there is a need for a measurement tool that has a high degree of validity and reliability. Therefore, this study is undertaken to develop a measurement tool to measure the effectiveness of physical education teachers' teaching and learning processes in the form of a scoring scale. This scale is expected to commendably quantify the teachers' teaching and learning processes in physical education realistically and consistently.

Materials and Methods

Research Type

This study is categorized as a developmental research by using interview and Q-Sort method. Richey and Nelson (1996) argue that a developmental study is a systematic study on the planning, development, evaluation, processes, and products that should have the criteria of internal consistency.

Research Design

Based on the research problem and research objective as elaborated earlier, this study needs a research design to attain the research objective. Nazir (2005) defines a research design as all processes required in the planning and conduct of a research. Accordingly, this study used the interview technique, item pool, and Q-sort method. Meanwhile, the framework of this study can be seen in the following chart.

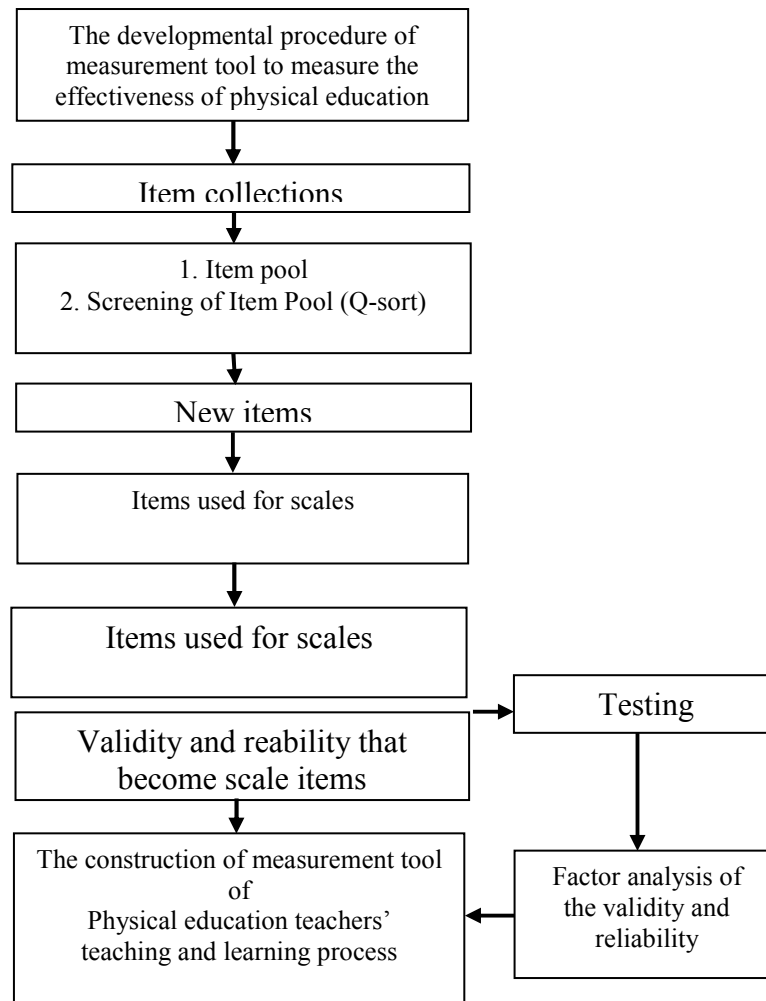


Fig. 1. Research Framework.

Research Subject

This study involved physical education teachers and public senior high school students in Banda Aceh, Indonesia. The total proportion of the students is 7598 from which 20 students were randomly chosen as samples. Meanwhile, four out of 27 teachers were randomly selected as samples as well. The interview was carried out with four teachers, and then the step of nominal group was done with 20 students, whereas the Q-sort was undertaken with five experts, and finally the testing step was conducted with 350 public senior school students.

Developmental Procedure

In the scientific research, there are three instruments commonly employed, namely: questionnaire, test, and scoring scale (Hadi, 1991). He further explains that questionnaire is used to investigate the subjects' viewpoints on certain information or to reveal the respondents' personal life. In addition, test is used to delve into an individual's characteristics, especially ability, aptitude, interest, attitude, and personality. Meanwhile, scoring scale is used to assess one's personal condition or a certain thing. Based on this explanation, all three instruments of test, questionnaire and scoring scale have similarities, particularly in terms of research objectives. Therefore, the instrument for the effectiveness of the physical education teachers' teaching and learning process

consists of the statements with the scoring scale between 1 (one) and 4 (four) based on the model developed by Likert. This scale is used to comprehend one of the pivotal requirements that should be possessed by a research instrument, that is, precision, apart from validity and reliability (Hadi, 1991).

The students were asked to respond to the statements according to what they personally had experienced by selecting the most appropriate items based on the conditions of the physical education teachers involved in their teaching and learning. The respondents' alternative answers had been determined by means of Likert Scale, namely: Strongly appropriate (or *sangat sesuai*, abbreviated as SS), Appropriate (or *sesuai*, abbreviated as S), Almost Appropriate (or *hamper sesuai*, abbreviated as AS), and not appropriate (or *tidak sesuai*, abbreviated as TS). The scoring was adjusted to SS=4, S=3, AS=2, TS=1. The effectiveness of the physical education teachers' teaching and learning process was according to the scores shown in the following table.

Table 1. Classification of the effectiveness of the physical education teachers' teaching and learning process based on scores of each item

Type of Instrument	Effectiveness of the Teachers' Teaching and Learning Process			
	Less	Enough	Good	Absolutely good
Scale of teachers' effectiveness in teaching	1-60	61-120	121-180	181-240

In order to design the instrument to measure the effectiveness of the physical education teachers' teaching and learning process, the researchers adopted the stages developed by Mutohir (1986), namely: item pool; (2) screening of item pool; and (3) construction of scales and (4) testing of instrument.

The collection of prospective items

The item was collected through two methods, which are the interview and the nominal group process technique. First, the interview with 20 students and four physical education teachers were. An interview guide was designed. The result of the interview was written down comprehensively.

Second, the collection of prospective items was carried out by means of the nominal group process technique. This was done to 20 students.

The stages of the nominal group technique in gathering the prospective items have been simplified by Mutohir (1987) to be in two stages. In the first stage, each participant were asked to gather in a room and asked to write things which concern them on the effectiveness of the physical education teachers' teaching and learning process on a piece of paper. These opinions were anonymously assessed by each group member to ensure freedom of expression (Sample, 1984). In the second stage, the results of the interview with the students and teachers were used in the group discussions. The results from the interview and discussion were then classified collaboratively between the researchers and Q-sort group members in accordance with 7 dimensions is teachers' knowledge, justice, interest, patience, leadership, enthusiasm and skill.

Screening of item pool with Q-sort technique

Based on Mutohir (1986, 1987), the screening process of item pool is conducted to reduce the items that reflect the effectiveness of physical education teachers' teaching and learning process. The selection of items was undertaken by means of Q-sort and factor analysis. Q-sort was done by collecting each item and written in a 5x5 cm paper. The procedure of Q-sort process was as follows: (1) determining group member of Q-sort (the researchers were assisted by 5 experts consisting of physical education lecturers and evaluation education lecturers; (2) giving the explanation pertaining the definition and the purpose of Q-sort to the members; and (3) selecting the items by the group members to each dimension and classify them into 3 categories, namely: "very important", "important enough", and "unimportant". The criteria of selection is the clarity of representative dimension and the degree of importance for each item that was assessed by the Q-sort group members (>60%). Through this stage, there were 93 items of the teachers' effectiveness considered and agreed to be the most essential. These items are further discussed later in the Result section.

Construction of scale

The assessment tool developed for this study was expected to be able to identify the indicators of the teachers' effectiveness in teaching and learning. The tool contains items that specify the teachers' effectiveness validly and reliably. Accordingly, the measurement tool was designed through particular procedures so that the item collection, item selection, testing, and the design of the assessment scale can scientifically be accountable.

Scale testing. In the outset, the dimension of the measurement tool was determined by means of factorial validity. This stage aimed at knowing the major factors regarding the teachers' effectiveness in teaching according to the students' perspectives. The design of the scale comprised: (1) the item analysis, (2) the reliability of assessment tool, (3) factor analysis, and (4) the design of assessment scale.

Data Analysis

The data that had been collected was then categorized and analyzed qualitatively and quantitatively. Qualitative data was used to explain the problems discussed more clearly. Meanwhile, quantitative data was analyzed by means of statistics techniques. The items collected as the indicators of the teachers' effectiveness in teaching were elicited from the interview and group discussion processes. The selection and category by using Q-sort became the items used in the testing process. Then, the testing result of measurement tool was analyzed

with the following statistic techniques: (a) the validity analysis of the items by using correlation coefficient, (b) the reliability analysis through Alpha Cronbach, (c) factor analysis by employing the principle techniques of Axis Factoring and rotation of Method Oblimin with Kaiser Normalization. All analyses were carried out by means of computers through Statistical Package for Social Science (SPSS) (Nie et al, 1975).

The Implementation Procedures

This study was conducted to design the students’ measurement tool of the physical education teachers at public senior high schools in Banda Aceh. Meanwhile, the procedures of the research process were as follows. The researchers contacted the Department of Education of Banda Aceh for permission to conduct the research. The researchers also called the schools, teachers, and the students who were selected as the research subjects. The subjects voluntarily accepted to be participants with written consents as a proof of their voluntary involvement. The researchers conducted a meeting with the students and teachers based on the schedules that had been determined. Then, the researchers carried out the stages, namely: interview, nominal group, Q-sort, and the division of the scales concerning the effectiveness of the physical education teachers’ teaching and learning process on the subjects that had been tested.

Results

Assessment Tool Testing

The testing result of the assessment tool revealed that all of the 93 items were deemed valid to be used in this study ($p > 0.05$). The reliability testing by using *Space Saver* formula shows that all seven factors (see Table 1) have the reliability coefficient with the alpha between 0.600 and 0.740. Thus, all seven factors have fulfilled the requirement of assessment that r_{test} should be higher than r_{table} . Therefore, that assessment tool offered a reliable result. Meanwhile, the result of reliability coefficient can be seen in Table 2 below.

Table 2. The summary of Reliability Coefficients (n = 350)

Factors	Knowledge	Justice	Interest	Patience	Leadership	Enthusiasm	Skill
Mean	70.774	33.062	46.714	39.551	53.128	37.720	52.183
Variance	87.121	0.643	14.721	2.991	4.429	4.728	1.158
Std Dev	6.645	1.662	3.903	2.500	2.883	2.725	2.081
N of variable	21	9	14	11	14	10	14
Case	350	350	350	350	350	350	350
r_n Alpha	0.738	0.600	0.706	0.675	0.729	0.740	0.658
r_{table}	0.105	0.105	0.105	0.105	0.105	0.105	0.105
Status	Reliable	Reliable	Reliable	Reliable	Reliable	Reliable	Reliable

Then, the testing of KMO and Bartlett’s test was conducted to know whether the variable and sample can be further analyzed or not. The testing of KMO and Bartlett’s test is 0.634 with the significance of 0.000. Therefore, that number is above 0.300 and the significance is far below 0.030 ($0.000 < 0.030$), and hence the variable and the sample can be further analyzed. To make it clearer, the output of KMO testing and Bartlett’s test can be seen in

Table 3.

Table 3. Output of KMO testing Result and Bartlett’s Test

Kaiser-Meycr-Oikin Measure of Sampling Adequacy		
Bartlett’s Test of Sphericity	Approx Chi-Square	.634
	df	97.617
	Sig	21
		.000

The testing of anti-image matrices or anti-image correlation was done to know the items included and not included in the factors. Meanwhile, the testing result of anti-image correlation showed that all 93 items were included in the factors. For a clearer output of the testing result of anti-image correlation, it can be referred to Table 4.

Table 4. The testing of Anti-image Matrices

No	Factors	r_{test}	Factor Status
Anti –image Correlation			
1.	Teachers’ Knowledge	0.502	Included
2.	Teachers’ Justice	0.670	Included
3.	Teachers’ Interest	0.590	Included
4.	Teachers’ Patience	0.649	Included
5.	Teachers’ Leadership	0.672	Included
6.	Teachers’ Enthusiasm	0.617	Included
7.	Teachers’ skill	0.663	Included

Based on the result of the factor analysis conducted several times, out of 93 items that are considered as the biggest in the seven dimensions, there were 60 items that had the factors bigger than 0.30 at the pattern matrix and appeared to a number of eliminated factors. However, the items used for the assessment tool for the effectiveness of the physical education teachers' teaching and learning process can be seen in Table 5.

Table 5. The testing result of *Pattern Matrix*

No		Components						
		Knowledge	Justice	Interest	Patience	Leadership	Enthusiasm	Skill
1	Understanding the concept of physical education	,592						
2	Understanding the knowledge of physical education	,543						
3	Understanding all branches of sport	,634						
4	Understanding the learning process well	,571						
5	Understanding an appropriate learning model	,467						
6	Understanding an appropriate learning strategy	,594						
7	Understanding the assessment of physical education well	,442						
8	Understanding a learning objective well	,564						
9	Having referee knowledge well	,491						
10	having anatomical knowledge	,704						
11	Having training knowledge well	,741						
12	Having good competence	,417						
13	Having the management of physical education teaching and learning process	,488						
14	Giving the score based on the students' ability		,773					
15	Not differentiating the students in the teaching and learning process		,681					
16	Caring about students		,658					
17	Giving an opportunity to the students to ask a question		,601					
18	Being just in the teaching and learning process		,824					
19	Appreciating each of the students' efforts		,481					
20	Being impartial in the teaching and learning process		,668					
21	Giving an objective score		,533					
22	Being able to please the students in the teaching and learning process			,691				
23	Not being boring in teaching			,420				
24	Understanding the students' characteristics and personality				,528			
25	Being Patient				,752			
26	Not speaking rudely				,630			
27	Not being egocentric				,496			
28	Not being angry fast in the teaching and learning process				,602			
29	Not being arrogant				,469			
30	Being responsible in the teaching and learning process					,705		
31	Being a role model in the teaching and learning process of the physical education					,575		
32	Taking a firm decision					,646		
33	Being Punctual in the teaching and learning process					,701		
34	Having a good character					,821		
35	Being on time					,645		
36	Being cooperative					,534		
37	Having good appearance					,632		
38	Being tolerant					647		
39	Not being rigid in the teaching and learning process					,458		
40	Being innovative					,688		
41	Being able to manage the class well					,649		
42	Being highly motivated in the teaching and learning process						,511	
43	Being able to give motivation						,678	
44	Being able to motivate the students in the teaching and learning process						,765	
45	Being able to make the students confident						,648	
46	Being able to make the teaching and learning						,531	

	process interesting							
47	Being able to explain the materials well							,813
48	Being able to design the appropriate lesson plan							,865
49	Being able to allocate the time well							,817
50	Being able to modify the rules of physical education							,588
51	Being able to modify the media used in the physical education							,640
52	Having a clear voice							,556
53	Being able to give a good example							,790
54	Being able to master the class well							,772
55	Reinforcing the teaching and learning process in the physical education							,852
56	Practicing the steps from beginning to the end							,639
57	Explaining the materials in detail							,649
58	Being able to interact well							,564
59	Having a good skill and physic							,543
60	Being able to train the students in the extracurricular activities							,728

Note: Extraction Method: Principal Axis Factoring
Rotation Oblimin with Kaiser Normalization

Effectiveness Factors in the Assessment Tool

Briefly, the assessment tool to measure the effectiveness of the physical education teachers' teaching and learning process was designed by collecting items as well as by going through the following steps: (1) interview, (2) nominal group, and (3) Q-sort group. That tool was then tested and the testing result was analyzed through the validity and reliability testing as well as the factor analysis.

Based on the analysis result, the factors and the items representing the effectiveness factors of the physical education teachers' teaching and learning process that were included in the scale of assessment tool to measure such effectiveness are discussed as follows.

Knowledge factor

Based on the validity and reliability testing and factor analysis, in terms of the knowledge factor, there were thirteen items related to the effectiveness of the physical education teachers' teaching and learning process that were included in the scale of assessment tool to measure the effectiveness of physical education teachers in teaching. Meanwhile, the knowledge factors comprises the good understanding of the concept of physical education, knowledge of physical education, all branches of sports, learning process, appropriate learning model, appropriate learning strategy, the assessment of physical education, learning objectives, and the management of teaching and learning process in physical education, and further having referee knowledge, anatomical knowledge, training knowledge, and good competence. The knowledge factor is the first factor in the scale of the assessment tool. The correlation between item scores and factor scores ranged between 0.741-0.417.

Justice factor

Based on the validity and reliability testing and factor analysis, in terms of the justice factor, there were eight items concerning the effectiveness of the physical education teachers that were included in the scale of assessment tool. Based on the validity and reliability testing and factor analysis, the eight items were giving the score based on the students' ability, not differentiating the students in the teaching and learning process, caring about the students, giving an opportunity to the students to ask questions, being just in the teaching and learning process, appreciating each of the students' efforts, being impartial in the teaching and learning process, and giving an objective score. The justice factor is the second factor in the scale of the assessment tool. The correlation between item scores and factor scores ranged between 0.824-0.481.

Interest factor

Based on the validity and reliability testing and factor analysis, in terms of the interest factor, there were two items related to the effectiveness of the physical education teachers. The interest factors contain being able to please the students in the teaching and learning process and not being boring in teaching. The interest factor is the third factor in the scale of assessment tool. The correlation between item scores and factor scores ranged between 0.691-0.420.

Patience factor

Based on the validity and reliability testing and factor analysis, in terms of the patience factor, there were six items related to the effectiveness of the physical education teachers. The patience factors were made up of understanding the students' characteristics and personality, being patient, not speaking rudely, not being egocentric, not being quickly angry in the teaching and learning process, and not being arrogant. The patience factor is the fourth factor in the scale of assessment tool. The correlation between item scores and factor scores ranged between 0.752-0.469.

Leadership factor

Based on the validity and reliability testing and factor analysis, in terms of the leadership factor, there were twelve items related to the effectiveness of the physical education teachers. The leadership factors consisted of

being responsible in the teaching and learning process, being a role model in the teaching and learning process of the physical education, taking a firm decision, being punctual in the teaching and learning process, having good characters, being on time, being cooperative, having good appearance, being tolerant, not being rigid in the teaching and learning process, being innovative, and being able to manage the class well. The patience factor is the fifth factor in the scale of assessment tool. The correlation between item scores and factor scores ranged between 0.705-0.458.

Enthusiasm factor

Based on the validity and reliability testing and factor analysis, in terms of the enthusiasm factor, there were five items related to the effectiveness of the physical education teachers. The enthusiasm factors consisted of being highly motivated in the teaching and learning process, being able to give motivation, being able to motivate the students in the teaching and learning process, being able to make the students confident, being able to make the teaching and learning process interesting. The enthusiasm factor is the sixth factor in the scale of assessment tool. The correlation between item scores and factor scores ranged between 0.765-0.511.

Leadership factor

Based on the validity and reliability testing and factor analysis, in terms of leadership factor, there were fourteen items related to the effectiveness of the physical education teachers. The leadership factors contained being able to explain the materials well, being able to design the appropriate lesson plan, being able to allocate the time well, being able to modify the rules of physical education, being able to modify the media used in the physical education, having a clear voice, being able to give a good example, being able to master the class well, reinforcing the teaching and learning process in the physical education, practicing the steps from beginning to the end, explaining the materials in detail, being able to interact well, having a good skill and physic, and being able to train the students in the extracurricular activities. The leadership factor is the seventh factor in the scale of assessment tool. The correlation between item scores and factor scores ranged between 0.865-0.543.

Furthermore, out of the many items designed, through further reduction and statistical analysis, finally there were only 60 items in the seven factors (the dimensions of knowledge, justice, interest, patience, leadership, enthusiasm, and skill) that were deemed valid and reliable to measure the physical education teachers' effectiveness in the teaching and learning process. Nevertheless, the scale of the teachers' effectiveness or Scale Effectiveness of Teaching by Teachers in Physical Education (SETTPE) can be seen in Table 6.

Table 6. The scale of assessment tool to measure the effectiveness of Physical Education teachers in the teaching and learning process

No.	Statement items	SS	S	AS	TS
	Understanding the concept of physical education				
	Understanding the knowledge of physical education				
	Understanding all branches of sport				
	Understanding the learning process well				
	Understanding an appropriate learning model				
	Understanding an appropriate learning strategy				
	Understanding the assessment of physical education well				
	Understanding a learning objective well				
	Having referee knowledge well				
	having anatomical knowledge				
	Having training knowledge well				
	Having good competence				
	Having the management of physical education teaching and learning process				
	Giving the score based on the students' ability				
	Not differentiating the students in the teaching and learning process				
	Caring about students				
	Giving an opportunity to the students to ask a question				
	Being just in the teaching and learning process				
	Appreciating each of the students' efforts				
	Being impartial in the teaching and learning process				
	Giving an objective score				
	Being able to please the students in the teaching and learning process				
	Not being boring in teaching				
	Understanding the students' characteristics and personality				
	Being Patient				
	Not speaking rudely				
	Not being egocentric				
	Not being angry fast in the teaching and learning process				
	Not being arrogant				
	Being responsible in the teaching and learning process				
	Being a role model in the teaching and learning process of the physical education				
	Taking a firm decision				
	Being Punctual in the teaching and learning process				
	Having a good character				
	Being on time				
	Being cooperative				
	Having good appearance				

Being tolerant				
Not being rigid in the teaching and learning process				
Being innovative				
Being able to manage the class well				
Being highly motivated in the teaching and learning process				
Being able to give motivation				
Being able to motivate the students in the teaching and learning process				
Being able to make the students confident				
Being able to make the teaching and learning process interesting				
Being able to explain the materials well				
Being able to design the appropriate lesson plan				
Being able to allocate the time well				
Being able to modify the rules of physical education				
Being able to modify the media used in the physical education				
Having a clear voice				
Being able to give a good example				
Being able to master the class well				
Reinforcing the teaching and learning process in the physical education				
Practicing the steps from beginning to the end				
Explaining the materials in detail				
Being able to interact well				
Having a good skill and physic				
Being able to train the students in the extracurricular activities				

Conclusion

The result of this study showed that the scale of assessment tool to measure the effectiveness of physical education teachers in the teaching and learning process consists of seven factors and 60 items, which have been tested to be valid and reliable. This scale has been replicated to test its suitability and reliability to the physical education teachers in public senior high schools in Banda Aceh. However, this scale needs to be further developed and tested to a wider group of different subjects to figure out the wider and larger implications of its suitability and reliability of an assessment tool to measure the effectiveness of the physical education teachers' teaching and learning process in a larger context. Nevertheless, this study was conducted with some limitations. The researchers do acknowledged that the factor analysis was merely limited to the stages used for the exploratory factor analyses/EFA, and not the stages for confirmatory factor analyses/CFA. Therefore, further research is suggested to touch this issue.

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