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by Susongko Purwo 3

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DETERMINANTS FACTORS ANALYSIS OF INDONESIAN STUDENTS' PHYSICS ACHIEVEMENT IN TIMSS 2011

P. Susongko*, M. A. Fatkhurrohman

Jurusan Pendidikan IPA, Universitas Pancasakti Tegal, Indonesia

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ABSTRACT

This study aimed to find the structure of the theoretical model that can illustrate the achievements of Indonesian students in the field of physics. This study also examines the variables that directly or indirectly influence the physics achievement of Indonesian students. The data in this study are data of TIMSS 2011 on physics test with population involved were 4572 Indonesian students grade 8. This research used path analysis from LISREL 8.30. The physics achievement model of Indonesian students based on TIMSS 2011 results are as follows: (1) physics achievement is directly influenced by self-confidence, interest in learning, and students 'attitudes toward the importance of physics; (2) physics achievement indirectly influenced by students' involvement in physics learning indicated from their interest and confidence in physics learning; (3) attitudes toward the importance of physics have an indirectly positive impact on physics achievement. Students' self-confidence in physics learning has a stronger direct influence on their achievements than their interest in physics.

ABSTRAK

Penelitian ini bertujuan untuk menemukan struktur model teoretis yang dapat menggambarkan prestasi siswa Indonesia bidang fisika. Penelitian ini juga meneliti variable–variabel yang berpengaruh secara langsung maupun tidak langsung terhadap prestasi fisika siswa Indonesia. Data penelitian ini berasal dari data TIMSS 2011 pada mata uji fisika dengan populasi yang terlibat sebanyak 4572 siswa Indonesia Kelas 8. Penelitian ini menggunakan path analysis dengan bantuan LISREL 8.30. Model prestasi fisika siswa Indonesia berdasarkan hasil TIMSS 2011 adalah sebagai berikut: (1) Prestasi fisika dipengaruhi secara langsung oleh percaya diri, minat belajar, dan sikap siswa terhadap pentingnya fisika, (2) Prestasi fisika dipengaruhi secara tidak langsung oleh keterlibatan siswa dalam pelajaran fisika melalui minat dan percaya diri dalam belajar fisika. (3) Sikap terhadap pentingnya fisika berpengaruh tidak langsung secara positif terhadap prestasi fisika. Percaya diri siswa dalam belajar fisika mempunyai pengaruh langsung yang lebih kuat terhadap prestasi mereka dibandingkan minat mereka terhadap fisika.

Keywords: determination; factors; Indonesian; physics achievement; TIMSS 2011

INTRODUCTION

High achievements in the fields of science and mathematics are important for students preparing for college, adjusting in the workplace, or in daily life (Mullis et al., 2012). A trend in International Mathematics and Science Study (TIMSS) produces contextual information of each country with regard to student achievement analysis and its comparations with the achievements of other countries. This international comparative study includes various factors such as: schools resources, family characteristics, and students' attitudes, all of which can affect students' achievement. Surveys conducted through TIMSS in the field of science include 8 aspects, namely: (1) International Student Achievement in Science (7 variables); (2) Performance at the TIMSS 2011 International Benchmarks (17 variables); (3) International Student Achievement in the TIMSS Science Content and Cognitive Domains (6 variables); (4) Home Environment Support for Science Achievement (4 variables); (5) School

*Correspondence Address:
Jl Halmahera KM 01 Tegal, 52121
E-mail: kusumatirto@gmail.com

Resources for Teaching Science (8 variables); (6) School Climate (6 variables); (7) Teacher Preparation (8 variables); and (8) Classroom Instruction (18 variables). Classroom Instruction is subdivided into 4 sub-variables; they are (1) Students' Attitudes toward Science; (2) Instructional Time; (3) Students Ready to Learn; (4) Classroom Resources and Activities for Teaching Science. Students' Attitudes toward Science consists of 3 variables, namely (1) Students Interest in Learning Science; (2) Students Value Science; (3) Students Confidence in Science (Martin, et al., 2012).

Indonesia has been involved four times in the TIMSS research for 8th grade in 1999, 2003, 2007, and 2011. In 2015 Indonesia only participated in the survey for grade 4. Based on data from four times following the TIMSS research, the average score of Indonesian students for the science category was 405 and in the category of Low Performance Country. This score is far below the average score of 500. The average score of Indonesian students for Science in the 2011 TIMSS survey was 406 or at rank of 40 of 42 countries. Specifically for physics test, the Indonesian students get score of 397 or at rank 40 of 42 countries. The first rank was achieved by Singaporean students with score of 602 and Malaysian students at the 32nd place with a score of 435 (Martin, et al., 2012). Based on these data, the score of physics material of Indonesian students was lower than the science score in general. There is interesting information related to the TIMMS Physics test of Indonesian students when they are given problems related to the ability to know what happens when molecules are cooled, only 35% of students can answer correctly. Similarly, when Indonesian students were given problems related to the influence of gravity on someone who did parachuting, none of Indonesian students managed to answer (Martin et al., 2012). This is a concern and requires serious efforts to fix those problems and improve its quality. Overall, the achievement of the Indonesian students' scores of sciences in Low-Interest (54%), Intermediate International Benchmarking (19%), High International Benchmarking (3%), and in the Advanced International Benchmarking category of 0% (Martin, et al., 2012).

There are a number of aspects surveyed in TIMSS. This fact provides an opportunity for further research relating to factors that significantly influence student achievement in a country, so that appropriate policy can be taken to improve the quality of education. Potential factors affect student achievement in some countries so that it can be mapped determination of variation between countries on student achievement. Similarly, on the achievement of Physics in Indonesian students, based on the acquisition of TIMSS it is necessary to find the root cause of the low achievement of Indonesian students. There needs to be a more comprehensive study related to the factors that are very dominant influence student's physics achievement, especially in Indonesia. This is homework for stakeholders in formulating policies for improvement in all aspects of learning. Therefore, the first step that can be done is to develop a model of physics achievement of Indonesian students based on the variables involved and measured in TIMSS.

Physics learning achievement is the main variable that often become the focus and the main indicator of teacher and student success in Physics learning. There are several studies involving many psychological variables that can be used as predictors of physics learning achievement. Ariyo and Ibeagha (2008) conducted research on physics learning in senior high school involving 22 schools, 22 principals, 22 physics teachers and 330 students with path analysis techniques. The research results show that there are 8 variables that significantly influence student's physics achievement in Nigeria: (1) physics general aptitude, (2) students 'gender, (3) students' attitude, (4) school type, (5) physics practical skills, (6) physics teacher qualification, (7) problem solving skills and (8) principal's area of specialization. Jahedi and Yari (2014) studied the influence of cognitive and emotional factors on physics learning achievement in high school students in Tabriz city, Turkey with linear regression and correlation analysis techniques. The results showed that: (1) there was a significant and positive relationship between epistemological belief, attitude toward science, prior knowledge of chemistry and mathematics with physics achievement, (2) there was a significant and negative relationship between physics anxiety and physics achievement.

A comprehensive study was conducted by Mujtaba and Reiss (2014) involving 5034 10th grade students (15 ages) from 137 schools in the UK in the 2008/2009 academic year related to Physics learning. This study uses factor analysis techniques and involves several variables including: motivation, intrinsic value of physic, home support for achievement

in physics, emotional response to physics learning, perceptions of physics learning, physics self -concept and advice pressure to study physics. The results of the study found that: (1) extrinsic motivation is the most important factor factors involving students' involvement, (2) advice-pressure to study physics and teachers is a key factor in order for students to learn physics continuously. Mujtaba and Reiss research (2014) is in line with previous research by Perez, Costa & Corbi (2012) which explains that the two main variables affecting learning achievement in general are Aptitude (general intelligence) and self concept (motivation) in addition to goal and effort orientation Self-involvement). The study involved 341 students and 7 variables using structural equation modeling (SEM) analysis techniques. The results of the research show: (1) General intelligence is a very dominant factor affecting learning achievement, (2) Student's goal orientation and academic self-concept very strong influence to effort (effort) or self-involvement in learning, (3) Student motivation and effort Students influence the selection of appropriate learning strategies.

Walberg (2004) developed the theory based on more than 100 research results about factors that affect the achievement of learning. The theory explains that factors influencing learning achievement are divided into three parts: (1) Variabell Student aptitude which includes previous ability or achievement, motivation or self-concept and mental development based on age, (2) instructional variables that include time And quality of learning and (3) environmental variables that include involving home, classroom peer and exposure to mass media. The first variable deals with the personal and background characteristics, the second variable relates to the learning aspect and the third variable relates to the social psychology of the home, class and peer atmosphere. With respect to Student aptitude variables, initial abilities were measured by standardized tests, motivation using survey and age-based mental development level (Paik, 2004; Reynolds & Walberg, 1992)

Suter (2000), in a study comparing mathematics and science achievement of students at international level using TIMSS data concluded that the differences in learning achievement among countries are determined more by curricular and teaching variables. Further, Suter (2000) cites the results of James Colamen's (1960) study which concluded that more achievements are determined by the family background than the school background. Similarly, Suter (2000) cites the conclusions of Gustafsson & Undheim (1996) that the differences in student's achievement among countries are more due to curricular and teaching variables than intelligence. Hayneman (1997: 29) found the opposite data that student personal variables are more determinants of achievement, especially motivation. Wilkins, Zembylas and Travers (2002) conducted a study with 1995 TIMSS data from 16 countries and gave results that belief in student self-efficacy was consistent predictor of mathematics and science achievement. Shen and Tam (2008) used TIMSS data (1995, 1999, and 2003) to examine the relationship between self-concept and achievement in grade 8 students. The results show that in all countries there is a positive and significant relationship between self-concept and achievement. Fathi, et al. (2013) conducted a study of TIMSS results in 2007 involving 3981 students with TIMSS data in 2007 and 4 variables of each science achievement, science self concept, father's education and attitude to science. The research used structural equation modeling (SEM) analysis and found that: (1) science self-concept and attitude toward science have positive impact on achievement; and (2) father's education has no significant impact on attitude to science. Topcu, et al. (2016) conducted a comparative study of factors affecting science learning achievement in Turkey and Korea based on TIMSS results in 2011. The study resulted in information that: (1) aptitude, learning and environmental aspects influenced the achievement of science; (2) in both countries, science self-efficacy and parental education levels have a significant impact on sians and mathematics achievement; and (3) School environment variables such as bullying and student sense of belonging at school have different impacts on both countries.

The Indonesian Education Assessment Center (2010) conducted a study of the results of TIMSS for science in 2007 on Indonesian students. The results of this study conclude as follows: (1) self-efficacy directly affect the achievement of science except for earth science; (2) attitudes toward the learning process affect self efficacy against the same subjects but not all of them continue to impact the self-efficacy of science achievement except for earth science; (3) students' perceptions of the importance and absence of science each affect the attitudes toward the lesson; (4) teaching methods can influence attitudes even if they occur only in

Biology and Chemistry (Indonesian Education Assessment Center, 2010: 32).

From the various studies of TIMSS both conducted abroad and in Indonesia there are several variables that consistently become predictors or consistently affect the achievement of learning, especially science and mathematics, although not all subjects have the same pattern. Of the various studies show that the achievements generated by students is not the result of a factor, but the result of various factors that are related to each other. Factors that are considered influential on physics learning achievement can be distinguished based on data obtained from the level of students from student questionnaires and school level from teacher and principal's questionnaire data.

At the internal level of students, there are several psychological theories that influence learning achievement. First, the theory was built by Heider (1958), who used the approach of attribution theory with a mathematical formula approach that connects performance factor (P), motivation (M) and ability (A) as in the following equation.

P = MXA (Indonesian Education Assessment Center, 2010).

As seen in the formula that the achievement of learning or performance is the result of interaction between motivation and ability. Thus students who have high motivation but have low ability will result in low performance, as well as those that occur in students who have high ability but have low motivation. Porter and Lawler (1968) developed different performance theories. The idea can be seen in Figure 1.

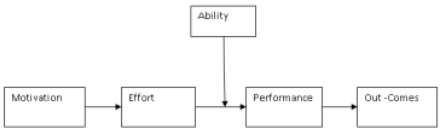

Figure 1. The relationship between motivation and learning outcomes by Porter & Lawler (Taylor, 2007).

Porter & Lawler's theory (Taylor, 2007) as described in Figure 1 shows that motivation gives influence to the effort to be performed. Conversely, efforts affect the performance, and ultimately the performance impact on learning outcome. Ability becomes a moderator of effort and performance relationships. A student may have high motivation and effort but with low ability leads to poor performance. Conversely some students have less effort but have a good enough performance because it has high ability.

This research is a preliminary study related to student physics achievement model of Indonesian students based on TIMSS data. In this regard, it is necessary to limit the variables involved so that the theoretical model can get support from the existing data. This study is limited to five variables that are at student level and related to physics learning are: (1) students' interest in and liking of learning physics; (2) students' attitudes about the importance of the physics); (3) students' self confidence in their ability to learn physics; (4) students' engaged in physics lesson; and (5) achievement in physics.

Therefore, this study aims (1) to find theoretical model structure that can illustrate the achievements of Indonesian students in the field of physics; (2) to find the variables that directly or indirectly affect the Indonesian student achievement in physics; and (3) to find the dominant variable influencing the Indonesian student achievement in physics.

METHOD

Data analyzed in this study is data from TIMSS 2011. The population is the students in grade 8 of each participating countries. Since following TIMMS's first research up to 2011, Indonesia has included for 8th graders. But by 2015 Indonesia is only included for grade 4. The sampling procedure for TIMSS 2011 has been determined by TIMSS & PIRLS International Study Center in cooperation with the Statistics Canada and the IEA Data Processing and Research Center. The research coordinator of each participating country along with the sampling expert from TIMSS selects the sample using the planned procedure. The sampling procedure used is a two-stage cluster design. On the first stage, the school sample was chosen proportionally to the size of the region whereas on the second stage, the class chose randomly from the designated school. All tests and questionnaires were given to all students in each class. This procedure is used to derive class-based conclusions as well as curriculum and learning experiences (Joncas & Foy, 2012). The 8th grade Indonesian students who were involved in the 2011 TIMSS study were 5795 from 153 state and madrasah schools (Joncas, 2011). There were 1223 students who were incomplete in responding to all the test

items or questionnaires so that they could not be used as sample members in the study, so that this study uses only 4572 sample sizes. Student response data is accessed by researchers from the Center for Educational Assessment, Research and Development Agency, Ministry of Education and Culture of the Republic of Indonesia.

Aspects of students interest were measured using Student Like Learning Scale (BSBGSLP); Attitudes toward the importance of physics were measured using the Student Value Science Scale (BSBGSVP); Students' self-confidence were measured using Student Confidence in Physics Scale (BSBGSCP); Students involvement in physics learning were measured using Student Engaged in Physics lesson Scale (BSBGEPL); and students physics achievement were measured using the average of 5 plausible physics scores (BSSPHY). Students Like Learning Scale consists of 5 items, Student Value Science Scale consists of 6 items, Student Confidence in Physics Scale consists of 6 items, and Student Engaged in Physics comprises of 5 items. All item composing questionnaires or tests have been tested and validated using Item Response Theory.

This study uses path analysis and followed by structural equation modeling (SEM) aided by software of LISREL 8.30. Path analysis is used to find the influence of the variables that directly or indirectly affect the physics achievement while SEM is used for confirmation of the hypothetical theoretical model. Path analysis uses to analyze the relationship between complex variables that can not be done with multiple regressions. In a complex relationship, there is more than one dependent variable so it takes a series of regression equations (Gudono, 2011: 218). In the model proposed in this study did not test the validity of items of each variable with factor analysis since all items used in the TIMSS study were validated previously using Item Response Theory

RESULTS AND DISCUSSION

Based on a number of 42 participating countries TIMSS 2011 for grade 8, there are 16 countries that presents physics, chemistry, and biology as separate subjects and there are 26 countries that serve it as an integrated science. Indonesia is one of the countries that presents physics as a separate subject (prior to the enactment of the 2013 curriculum). The ranking of aspects of Indonesian self-interest, self-confidence and self-involvement in physics learning based on the 2011 TIMSS study from 16 countries can be seen in Table 1.

Table 1. interest, confidence and self-involvement in Indonesian student physics leaning in the 2011 TIMSS study.

Variables	Ranks
Student Learning Physics	14
Students' attitudes toward the importance of physics	11
Confident students in learning physics	16

To facilitate analysis in SEM, physics learning interest variable abbreviated as Like, student attitudes toward the importance of physics with Value, confident in studying physics with Confident, and for student involvement in physics lesson with Engaged. The result of SEM analysis with LISREL 8.30 software can be seen in Figure 2. Criteria for goodness of fit test (GFT) of the model can be seen in Table 2.

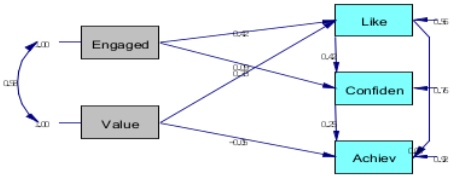

Figure 2. The Theoretical Model of Physics Achievement of Indonesian Students Grade 8 (Standardized, n = 4572)

Figure 2 illustrates the theoretical model of physics achievement of 8th grade Indonesian students in TIMSS 2011 study. Physics achievement model of Indonesian students based on TIMSS 2011 results in Figure 2 can be explained as follows: (1) students' attitudes toward the importance of physics and student involvement have a direct positive impact on interest Students; (2) student involvement has a direct positive impact on confidence; (3) student interest has a direct positive impact on confidence; (4) students' self-confidence and student interest positively affect the physics achievement; (5) attitudes toward the importance of physics have a direct negative impact on physics achievement; (6) student involvement and attitudes toward the importance of physics correlate strongly enough. All relationships between va-

Table 2. Several Goodness of Fit Test (GFT) measures in SEM

Size of GFT	Test Criteria	Results	Conclusion
P value	≥ 0.05	0.93	model very good fit
λ^2 /df	≤ 2	0.075	model very good fit
Size of GFT	Test Criteria	Results	Conclusion
Root Mean Square Error of Approximation (RMSEA)	≤ 0.08	0.000	model very good fit
Goodness of fit index (GFI)	≥ 0.9	1	model very good fit
Adjusted Goodness of fit index (AGFI)	≥ 0.9	1	model very good fit
Comparative fit index (CFI)	≥ 0.9	1	model very good fit
Normal fit index (NFI)	≥ 0.9	1	model very good fit
Non Normal fit index (NNFI)	≥ 0.9	1	model very good fit

(Kusnendi, 2008 ; Ghozali & Fuad, 2005)

riables as shown in Figure 1 are signified at the 95% confidence level as shown by Table 2. The quantity of direct or indirect impacts between the variables involved can be seen in Table 3 whereas the correlation between the dependent and independent variables can be seen in Table 4.

Based on all the parameters as described by Table 2 shows that based on the nine criteria, the results of SEM analysis can be declared acceptable even to complete. One character of the Likelihood Ratio Test (λ2) is the higher the value the relatively low P-count value will be generated, and vice versa. Very much expected Likelihood Ratio Test as small so that the value of P becomes large. Other characteristics of λ2 statistics are sensitive to sample size (Schumaker & Lomax, 1996; Hair, et al., 1998). The larger the sample size the λ2 statistic obtained tends to increase with smaller P-values, so that for large sample sizes the statistics λ2 tend to reject the model (Joreskog & Sorbom, 1996). But apparently it does not occur in SEM analysis conducted in this study, with the sample size of 4572 value λ2 is 0 and the value of P approaches 1 one that is equal to 0.93. This shows that the model produced in this research has high absolute fit measure (AFM). AFM informed the model's ability to accurately estimate the population covariance matrix based on the sample covariance matrix. The two most salient measure of absolute suitability of the LISREL version are Likelihood Ratio Test (λ2) and Root means Square Error of Approximation (RMSEA) (Joreskog & Sorbom, 1996).

The result of SEM analysis according to Figure 2 shows that: (1) physics achievement is directly influenced positively by students' self-confidence and student's interest to learn physics respectively equal to 0.25 (6.25%) and 0.08 (0.64%); (2) physics achievement influenced directly by negative attitude of student toward physics significance equal to -0.05 (0,25%) but indirectly have positive impact equal to 0.06 (0.36%) through student's interest to learn physics and students' confident; (3) physics achievement influenced indirectly positively by student interest in physics learning equal to 0.10 (1%) through student self-confidence; (4) physics achievement is positively indirectly influenced by 0.10 (0.1%) by students 'self-involvement in physics learning through the students' learning interest in physics and self-confidence; (5) students' self-confidence in physics learning was directly influenced positively by the interest of physics study and self-involvement of students in physics learning respectively 0.42 (17.64%) and 0.09 (0.81%); (6) students' interest in physics learning is directly influenced by students' self-involvement in physics learning and students' attitudes toward the importance of physics respectively 0.42 (17.64%) and 0.33 (10.89%); (7) students 'self-involvement in physics learning is positively correlated by 0.58 with students' attitudes toward the importance of physics. The correlation of 0.58 between these independent variables does not interfere with the assumption of multicollinearity (Kusnendi, 2008).

The results showed that students' self-confidence is very dominant influence on physics learning achievement. This is in line with most of the results of research as is demonstrated by Wilkins, et al. (2002), Shen and Tam (2008), Puspendik (2010), Fathi et al., (2013),

Table 3. Estimation and Testing Parameter Model Achievement of Physics Learning

Model	Estimation	t	ErrorVar	R^2
Engaged → Like	0.42	30.65	0.01	0.1764
Engaged→ Confident	0.09	5.73	0.02	0.0081
Value →Like	0.33	24.21	0.01	0.1089
Value →Achiev	-0.05	-2.93	0.78	0.0025
Like→ Confident	0.42	25.98	0.02	0.1764
Confident →Achiev	0.25	15.57	0.66	0.0625
Like →Achiev	0.08	4.14	1.00	0.0064

Value of t table of 95% and n>30 is ± 2.00

Table 4. Influence of Variable Decomposition of Physics Learning Achievement Model

Variabel Influence	Influence		
	Directly	Indirectly	Total
Engaged → Like	0.42	-	0.42
Value →Like	0.33	-	0.33
Like→ Confiden	0.42	-	0.42
Engaged→ Confiden	0.09	0.18	0.27
Like →Achiev	0.08	0.10	0.18
Confiden →Achiev	0.25	-	0.25
Engaged→ Achiev	-	0.10	0.10
Value →Achiev	-0.05	0.06	0.01

Table 5. Correlation Matrix of dependent variable and independent variable

	Like	Confident	Achiev	Engaged	Value
Like	1				
Confident	0.48	1			
Achiev	0.17	0.27	1		
Engaged	0.61	0.35	0.11	1	
Value	0.57	0.30	0.07	0.58	1

Mujtaba & Reiss (2014), as well as Topcu, et al. (2016) researches. It can also be seen from the students' confident correlations in physics learning with high physics achievements as described in Table 5. Confidence is also strongly influenced by students' interests and students' interests strongly influenced by students' involvement and student attitudes toward the importance of physics.

Student involvement in physics learning has no direct impact on physics achievement, but still has an indirect impact of 0.1 through students' interest and confidence. This is in accordance with research Mujtaba & Reiss (2014) and research results Perez et al, (2012) where student involvement in learning is one of the factors that affect learning achievement. Willms's research (2003) on PISA data also proves that student involvement has a strong correlation to science literacy. The results of this study also shows that attitudes toward the importance of physics have a direct negative impact on the achievement of walaupaun is very small only -0.05 while the indirect influence through interest in physics and self-confidence is only 0.01. The results of this study differ from some previous studies. Vahedi & Yari (2014) and Fathi et al. (2013) have reported that students' attitudes toward the importance of physics directly affect physics achievement. However, the results of Puspendik (2010) studying the results of TIMSS 2007 concluded that students' attitudes toward the importance of science influence attitudes toward science lessons but have no

direct impact on science learning achievement. Thus it can be concluded if attitudes toward the importance of physics have a weak influence on physics achievement for Indonesian students.

Indonesian students' interest in physics, according to TIMSS 2011 results, is the latest ranking of 16 countries that teach physics separately. This is truly a serious problem that must be addressed immediately because the results of the study indicated that the interest in physics study has a strong correlation with self-confident, involvement in physics learning, and students' attitudes toward the importance of physics (Table 4) which also corresponds to the research of Akarsa & Kariper (2013). According to the four correlated variables, it can be concluded that students' attitudes toward the importance of physics and student involvement strong enough influence on student interest and subsequently the student's interest is strong enough to confidence and finally self-confident students influential strong enough to the achievement of physics. From this relationship, students' attitudes toward the importance of physics need to be grown in order to build a high learning interest in physics learning. To cultivate a positive attitude toward the subject of physics, the students' perception of physics needs to be encouraged and motivated. Concern of the improvement of students' interest is important because in general students perceive physics learning as a complex and difficult to follow (Cetin, 2016). Santiboon, et al. (2012) stated that the improvement of physics laboratory facilities can enhance students' perceptions of physics learning. Not only in physics, improvement of students' interest in physics and learning motivation also impactive in improving science achievement in general (Rana, et al., 2015).

The facts about the increased involvement of students in physics lessons have been revealed through the innovation of physics-based learning model of students' activity which has a positive impact on student achievement about physics concept (Hatika, 2016, Pratiwi & Muslim, 2016; Damawati & Juanda, 2016; Siswanto, Et al., 2016; Ismawati, et al., 2014; Bautista, 2012). Similarly, the creativity of media usage and assessment model involving students in more intensive ways can improve physics learning achievement (Gunawan, et al., 2016; Shanti, et al., 2014; Nuryantini, et al., 2015). The involvement of Indonesian students in physics learning needs to be improved again by applying various strategies and learning models. This is because in accordance with the results of TIMSS 2011, the achievement of Indonesian students is still ranked 15th out of 16 countries that teach physics separately.

Aspects that determine the achievement of students in learning physics is the students' self-confident. Therefore, efforts to increase students' self-confident are very important to be the main educators' concern. The TIMSS 2011 survey results show that Indonesian students have the lowest confident level, which is ranked 16th out of 16 participating countries that present physics separately. In fact, many learning models can be applied to improve students' self-confident in physics learning, such as the use of generative learning models (Yuliarti, et al., 2015), problem-based learning (Wiratmaja, et al., 2014), and blended cooperative learning (Jarnawi & Untara, 2016).

CONCLUSION

Physics achievement model of Indonesian students based on TIMSS 2011 results are as follows: (1) students' attitudes toward the importance of physics and student involvement have a direct positive effect on student interest; (2) student involvement has a direct positive effect on confident; (3) student interest has a direct positive effect on confident; (4) students' self-confident and student interest positively affect the physics achievement; (5) attitudes toward the importance of physics have a direct but negative effect on physics achievement; (6) student involvement and attitudes toward the importance of physics correlate strongly enough.

Student achievement of physics is influenced indirectly by the involvement of students in physics learning which is indicated through interest and confident in learning physics. Attitudes toward the importance of physics have an indirectly positive effect on physics learning achievement. Students' self-confident in physics learning has the strongest direct influence beyond interest and confident. Dealing with results as Figure 1 (Porter & Lawler in Taylor, 2007) , the relationships between motivation and learning outcomes can be shown in Figure 3.

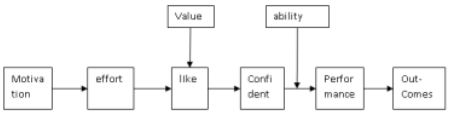

Figure 3. The relationships between motivation and learning outcomes from Indonesian Students' Physics Achievement In TIMSS 2011

The results of the study provide recommendations that in the future it can be developed learning model based on student involvement in learning; cultivate a high interest in learning physics; as well as fostering a great student confident in learning physics. Positive attitudes about the importance of physics also need to be developed and grown in the students so as to support the involvement and interest of students in learning physics.

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