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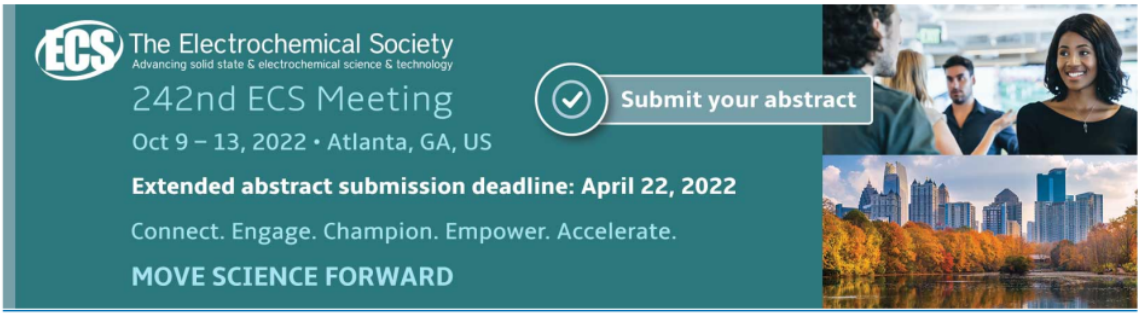

The model of science proficiency of Indonesian students in PISA 2015

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Abstract. The objectives of this research are: (1) to find theoretical model that can illustrate the science Proficiency of Indonesian students, (2) to know the factor factors that predominantly influence the science Proficiency of Indonesian students. The research was conducted using ex post facto method using PISA 2015 data for Indonesia as many as 6088student responses. Data analysing used structural equation modelling which involve 14 observed variables and 3 latent variables and limited to the variables measured at student level. The research result showed that the Science Proficiency of Indonesian students are positively influenced by the background students and the quality of science learning. Student backgrounds can be indicated by Index of economic, social and cultural status and ICT Resources. The quality of science learning can be shown by indicators: disciplinary climate in science classes, teacher motivation in science classes of student choices, teacher-directed science instruction, and perceiving feedback. Science Proficiency of Indonesian students can be shown by indicators: environmental awareness, science self-efficacy, epistemological beliefs, sense of belonging to school, and plausibly value of science. The results also show that the background aspect of Indonesian students is more dominant in influencing science proficiency than the quality of learning.

1. Introduction

Indonesia had joined four times TIMSS in the eighth grade (Junior High School) since 1999, 2003, 2007 and 2011. In 2015 Indonesia only joined surveying the fourth grade. Since four times it joined TIMSS (1999-2011), it got sciences score 405 or it was included of Low Performance Country category, it was far from the average scores of 500 [1]. For PISA survey outcome, Indonesian student skills in sciences weren't pleased. Even in 2012, Indonesian student achievements in sciences were on 71th grade from 72 countries. PISA survey in 2015, scientific performances among students in fifteen age enhanced 21 points (from 382 points in 2012 to 403 points in 2015), and it got rank of 64 from 72 participant countries. However, these results were still under of neighbor country achievements like Vietnam and Thailand [2]. These are something pity as has known that student scientific literacy is the main goal of science education [3].

Related to the low of student scientific literacy achievement, it is necessary the basic remedy in sciences education in Indonesia. The remedy needs more information about how Indonesian students learn sciences then be made sciences Indonesian student achievement model. By using this an accurate model, it can be developed to all aspects which influence Indonesian students sciences learning achievement so then it can be advance developed in learning, evaluation model, giving motivation model

and developing learning facility model. This model is expected able to represent Indonesian student learning theories which can be confirmed the truth empirically. This is because a theory must be the implication from the observed phenomenon in the real life [4]. Susongko and Fatkhurrohman [5] had examined to find theoretic model structure which could explain Indonesian student achievements in Physics and the variables directly and undirectly to Indoensian student achievements in Physics. Data analyzing in this study used TIMSS Physics study in 2011 with research population 4572 of Indonesian students of the eighth grade. This study used path analyzing with LISREL 8.30. The model of Physics achievement Indonesian students based on TIMSS survey in 2011 are: (1) Physics achievement was influenced by confidence, learning interest and student attitudes in Physics directly, (2) Physics achievement was influenced undirectly by student participating in Physics learning through students interest and confinedence in physics leanring, (3) the attitude of the important of Physics was influenced undirectly in Physics learning. Student confidence in Physics learning had direct influence the most [5].

Susongko analyzed influenced factors on Science Proficiency of Indonesian students so that it gave more information to enhance Science Proficiency of Indonesian students. This study used 5956 student responds from PISA study in 2015. This study used 16 variables based on work outline of PISA in 2015 and it was believed to give influence on Science Proficiency. Data analyzing technique used exploratory factor analyze. There were four factors influenced on Science Proficiency of Indonesian students based on PISA study in 2015. They were: (1) student backgrounds, (2) scientific learning, (3) scientific attitudes and (4) school environment. Student background factor can be explained by six variables, they are: (1) joy at home, (2) educating devices at home, (3) Home facilities, (4) Information technology facilities, (5) family's wealth, (6) the index of social, economic and cultural. Sciences learning factors can be explained through three variables, they are: (1) teacher's motivation in sciences, (2) inquiries learning, and (3) teacher's instruction learning. Sciences attitude factor can be explained as (1) environmental awareness, (2) sciences fondness, (3) sciences learning motivation, (4) sciences learning confidence, and (5) student's epitemic belief. School environemnet factor canbe explain by two variables each sciences learning disciplinary and joyable school [6].

2. Methods

Research data is taken from PISA database which can be accessed in OECD page at http://www.oecd.org/pisa/data/2015database/, data code is PUF_COMBINED_CMB_STU_QQQ_Zip. There are 519.334 responds from 72 counties and there are 921 variables related to students. There are 6513 Indonesian students who participated PISA Survey and only 6088 which are used because of unfullfill data from students. More than a half of total students are in the ninth grade [2].

In this case, science proficiency is limited by seven indicators learning quality is limited by five indicators and student background is limited by two indicators. This limit is made based on the data which can be accessed in OECD page. Seven indicators of science proficiency are: (1) environmental awareness , (2) students' enjoyment of learning science or Enjoyment of Science (JOYSCIE), (3) students' instrumental motivation (INSTSCIE), (4) students' self –efficacy in science or science self-efficacy (SCIEEFF), (5) students' epistemic beliefs orepistemological beliefs (EPIST), (6) subjective well-being or sense of belonging to school (BELONG) and (7) plausible value of science (PVSCIE). Five indicators of learning quality are (1) Disciplinary climate in science classes (DISCLISC), (2) teacher support in a science classes of students choice (TEACHSUP), (3) Inquiry-based instruction in science lesson (IBTEACH), (4) teacher-directed science instruction (TDTEACH), (5) perceived feedback (PERFEED). While the indicator of student backgrounds are Index of economic, social and cultural status (ESCS) and ICT Resources (ICTRES).

Data analyzed technique use structural equation modeling (SEM) with LISREL 8.30 software. SEM is used to confirm theoretical model in hypothesis and to examine the validity each indicator based on the model. The significant degree to relate each variable is 5 % (0.05). This model does not examine item validity because all items in PISA study have been validated before by using item response theory.

3. Results and Discussion

Measuring of model examination is made through two steps, they are: (1) the test of model compatibility (overall model fit), (2) the evaluation of indicator validity [7]. Research result can be seen at Picture 1. The standart of goodness of fit test (GFT) model can be seen in the Table 1, while the test of model parameter can be seen in the Table 2.

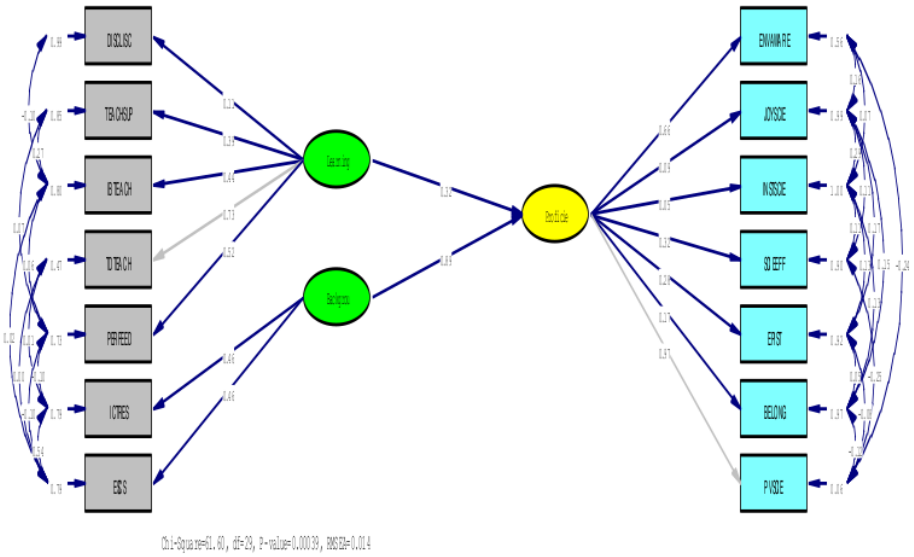

Figure 1. The test of compatibility model of Science Proficiency Indonesian Students based on PISA in 2015 (Standardized)

Table 1. Some of the standart of goodness of fit test (GFT) in SEM

GFT standart	Test criteria	Test result	conclusion
P value	≥ 0.05	0.0004	not good model
χ^2/df	≤ 2	2.12	good fit model
Root Mean Square Error of Approximation (RMSEA)	≤ 0.08	0.0137	good fit model
Goodness of fit index (GFI)	≥ 0.9	0.999	good fit model
Adjusted Goodness of fit index (AGFI)	≥ 0.9	0.995	good fit model
Comparative fit index (CFI)	≥ 0.9	0.998	good fit model
Normal fit index (NFI)	≥ 0.9	0.996	good fit model
Non Normal fit index (NNFI)	≥ 0.9	0.993	good fit model
Icremental Fit Index (IFI)	≥ 0.9	0.998	good fit model
Relative Fit Index (RFI)	nearly 1	0.987	good fit model
Adjusted Goodness of Fit Index	≥ 0.9	0.995	good fit model

Table 2. The Test of Model Parameter of Science skills Indonesian Students

Model	Estimation	t	Errorvar	R^2
Model measurement				
ENVAWARE <--- Proficiency	0.662	25.073	0.562	0.438
JOYSCIE <--- Proficiency	0.088	5.746	0.992	0.008
INSTSCIE <--- Proficiency	0.054	3.857	0.997	0.003
SCIEEFF <--- Proficiency	0.320	14.480	0.898	0.102
EPIST <--- Proficiency	0.278	13.557	0.923	0.077
BELONG <--- Proficiency	0.173	9.328	0.970	0.030
PVSCIE<--- Proficiency	0.972	-	0.055	0.945
DISCLISC<--- Learning	0.107	6.140	0.988	0.012
TEACHSUP <--- Learning	0.385	11.018	0.852	0.148
IBTEACH <--- Learning	0.442	11.340	0.805	0.195
TDTEACH <--- Learning	0.728	-	0.470	0.530
PERFEED <--- Learning	0.521	11.393	0.729	0.271
ICTRES <--- Background	0.457	21.355	0.791	0.209
ESCS <--- Background	0.458	21.433	0.790	0.210
Structural model				
Proficiency <--- Learning	0.323	5.695	0.896	0.104
Proficiency <--- Background	0.887	21.433	0.213	0.787

From nine parameters as shown in the Table 1, there are eight parameters which fulfill the criteria so then it can be stated as model from SEM analyzing accept. The unfulfill criteria in this confirm test is the lowness of probability values (P), it is 0.0039 and it is under minimum criteria of 0.05. It is caused by P value depend on Likelihood Ratio Test ($\lambda 2$) value. One of the characteristic from Likelihood Ratio Test ($\lambda 2$) is the higher value will make P-count value lower and the reversed. It is expected that Likelihood Ratio Test has the smallest value so that P value is bigger. The other characteristic of $\lambda 2$ is it is sensitive to sample dimension [9]. The bigger of sample dimension then $\lambda 2$is bigger and P value is less, so for large sample dimension $\lambda 2$ is leaned reject model [10]. It shows the model from this research has not had a high absolute fit measure (AFM). AFM informs model ability to estimate covariant matrix absolutely based on covariant matrix sample. The main of two absolute dimensional are statistic Likelihood Ratio Test ($\lambda 2$) and Root means Square Error of Approximation (RMSEA) [10]. But, this model still can be accepted because of all criterias, there only one criteria, it is probability values (P) which hasn't fulfilled caused by the dimensional sample is too large.

All variables relating is shown in Picture 1, it is the significant in belief level 95 % as shown in the Table 2. In the structural model looks that student background influences strongly to science proficiency of Indonesia students. From the Table, it can be seen that student background is twice stronger than learning quality, and if we look from determinate level, 78.7 % science proficiency of Indonesia students can be explained from student backgrounds. This result is suit with PISA invention where social an economic status always influenced to student, school and education system outcomes constantly [11]. A high social and economic status is often related to high wealth and high shop in education. In the school level, social economic status is leaned positive correlation with all the characteristic of humanity which can enhance student's achievements, like safe environment, library and museum. In individual level, social-economic status can be related to parent's behavior and participating of parents in education. This research result enhances some of previous research about social-economic impact to student learning achievement [12-14]. This research also shows Index of economic, social and cultural status (ESCS) and ICT Resources (ICTRES) is valid as background indicator with about 20 % of determination coefficient.

Learning quality influences 0.323 or with determinant level of 10.4 %. In sciences learning, many teachers in Indonesia, Korea and Peru, do not give many instructions to students than science teachers from OECD countries [15]. From those three countries, Teacher-directed science instruction does not influence to science score, but it influences to epistemic belief. Teacher-directed science instruction index for Korea is the lowest, and Indonesia is under average of OECD countries, Singapore is above from OECD value, but Teacher-directed science instruction does not influence to science score and epistemic belief [15].While for perceived feedback and Inquiry-based instruction in science lesson in Indonesia is above from OECD countries or it is in 20th grade from 72 countries. Perceived feedback and Inquiry-based instruction in science lesson in Indonesia does not influence to science score but to epistemic belief [15]. They make it influence to learning quality of Indonesian students becomes weak and in this case is only 10.4 %. This suits with PISA report which shows that standing countries with high science performance level does not influence to learning quality [15]. It can be stated that background of economic, social and cultural influences to science performance strongly.

For disciplinary climate level, Japan, Korea, Singapore and Indonesia are above among of OECD countries. It means that science learning in the classes in Japan, Korea, Singapore and Indonesia's school are more comfort and condusive than the situation of class from the other countries. For Indonesia, disciplinary climate influences on science performance [15]. Teacher's support index in science learning is above from OECD countries and it does not influence to science performance [15]. For those five variables in sciences learning in the school, only a disciplinary climate index which influences to science performance, so it is right if the influence of learning quality is less than student backgrounds. However, this research shows that those five variables are valid as learning quality indicators. From seven science proficiency indicators as conceptual model, there are two indicators, they are: student's enjoyment of learning science and student's instrumental motivation which have determination coefficient very small each 0.008 and 0.003. Inversely, for the environment awareness of Indonesian students can explain 43.8 % from science proficiency. It means science education in Indonesia has been able to enhance the environment awareness among students. It also can enhance the student's self–efficacy in science, the students' epistemic belief and the sense of belonging to school. This analyze also shows those seven indicators are valid as science proficiency of Indonesian students standard.

4. Conclusion

The model of Science Proficiency of Indonesian students is able to be arranged by: Science Proficiency of Indonesian student is influenced by student backgrounds positively and the quality of science learning. Student backgrounds can be shown by Index of economic, social and cultural status indicator and ICT Resources. The quality of learning can be shown by indicators: (1) Disciplinary climate in science classes, (2) Teacher's support in a science classes of student's choice, (3) Inquiry-based science teaching and learning practices, (4) Teacher-directed science instruction, (5) Perceived Feedback. Science Proficiency of Indonesian students can be shown by indicators: (1) Environmental Awareness, (2) Science self-efficacy, (3) Epistemological beliefs, (4) Sense of Belonging to School, (5) Plausible Value of Science. This result shows that Indonesian student backgrounds aspect is more dominant to influence Science Proficiency than learning quality.

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