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CONCEPTION OF LEARNING PHYSICS AND SELF-EFFICACY AMONG INDONESIAN UNIVERSITY STUDENTS

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Abstract. *This research aimed to explore the correlation between Indonesian University students' conception of learning physics and their physics' self-efficacy. A total of 279 students who were majoring in physics education participated in this research and were invited to complete two instruments: the conception of learning physics (CLP) and the physics learning' self-efficacy (PLSE). Both of the questionnaires, which were modified from [Lin, Liang, & Tsai (2015a) and Lin, Liang, & Tsai (2015b)]' instruments, had been translated into Indonesian language and validated through an exploratory factor analysis of participants' responses. The differences between student levels were explored for their significance using an ANOVA test in order to portray a clear line among different conceptions of learning physics and physics learning self-efficacy. The results indicated that, first, the instruments used in the research had satisfactory validity and reliability. Second, students in sophomore level were significantly lower on the conceptions of testing than those in other levels. Meanwhile, the conceptions of calculating-practicing and understanding were not significantly different. Third, university students in senior level performed more confident in four dimensions: science content, higher-order thinking, everyday application, and science communication than others. The research also depicted a moderate correlation among dimensions of CLP and PLSE.*
Key words: *conception of learning, physics education, self-efficacy, survey study, university student.*

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Introduction

Many studies concerned about self-efficacy in science education. The studies have used, ranging from an elementary science student to university level. Some researchers have explored the significant influence of students' conceptions of learning science on their science learning self-efficacy (e.g. Chiou & Liang, 2012; Lin, Liang & Tsai, 2015a; Lin, Liang & Tsai, 2015b; Tsai, Ho, Liang, & Lin, 2011). However, not at all concerned on the university student level of self-efficacy scale. In this level, some previous researchers studied about physics self-efficacy (e.g. Lin, Liang & Tsai, 2015a; Lindstrøm & Sharma, 2011; Sawtelle, Brewe, & Kramer, 2012), chemistry self-efficacy (Uzuntiryaki & Aydın, 2009), and biology self-efficacy (Lin *et al.*, 2015b). Self-efficacy ratings are not only informative to students, but also produce self-regulatory reactions, such as increasing studying to score better in the classroom (Zimmerman, Bonner, & Kovach, 2006). There is a linear relationship between students' self-efficacy and their performing in tasks. Consequently, in educational settings, students who hold strong self-efficacy beliefs in determining a given project and doing it successfully are likely to employ in the task, while fewer self-efficacious students were distinct to avoid it (Pintrich & Schunk, 2002). In addition, self-efficacy is a predictor of academic performance (Uzuntiryaki & Aydın, 2009). Students who have a high efficacy would perform better in their academic tasks than those with low efficacy.

In the present research, the role of university students' various conceptions of learning in their academic self-efficacy in the domain of physics is initially explored. Specifically, the focus of the research is to identify university students' conception of learning physics and to understand how these distinct conceptions relate to physics learning' self-efficacy in Indonesia. In addition, the relation between each component of conception of learning and self-efficacy in the domain of physics is also examined.

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Conception of Learning Physics

Some of the empirical studies have been extended to explore students' conceptions of learning science. Tsai (2004) classified seven conceptions of learning science, comprises memorizing, preparing for tests, calculating and practicing tutorial problems, increasing of knowledge, applying, understanding, and seeing in a new way. However, among these conceptions, only three conceptions are considerably important to when investigating Taiwanese students' conceptions in physics (Lin *et al.*, 2015a, Tsai, 2004). The authors argued that the situation has also happened in other Asian countries, including Indonesia. The first conception is understanding for promoting meaningful learning in physics among Indonesian university students. The process of understanding portrayed an active learning style and often reveals to great quality outcomes (Tran, 2013) and indicated that students with a conception of learning as understanding tend to improve learning strategies (Dart *et al.*, 2000). The second conception is calculating and practicing conception. Physics education, as well as learning activities often provides scientific knowledge, consists of equations, formulae, calculations, and the test patterns encompass the process of calculation and tutorial problem solving (Kim & Pak 2002; Thomas 2013). The third conception is the learning conception of testing. The testing conception is the most strongly influential factor related to the highly competitive examination system in Indonesia.

The three conceptions of learning science (understanding, calculating-practicing, and testing) in-line with Lin *et al.* (2015a) who made a simple conception of learning science. The three conceptions can potentially be presumed as the key conceptions to consider when exploring students learning in physics. The researchers believe that investigating these three fundamental conceptions may lead to different learning pattern structures (i.e., conceptions of learning physics). Therefore, one of the main aims of the current research was to gather the role of these three conceptions in order to identify Indonesian university students' conception of learning specific to physics learning.

Self-Efficacy

Bandura (1986) stated that people perform tasks based on their own beliefs in specific situations, known as self-efficacy. Self-efficacy has been defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986). Self-efficacy is a key concept in Bandura's social cognitive theory, which indicates that behavior is best understood in terms of a triadic reciprocal system: cognition, behavior, and environment. The notion of reciprocal determinism in social cognitive theory, means perceived ability to perform the task, behavior, performance, and environment setting (Chang, McKeachie, & Lin, 2010).

Self-efficacy is a crucial construct for students to monitor their performance because it focuses attention on their beliefs about the effectiveness of their learning methods (Zimmerman *et al.*, 2006). The goal of self-efficacy monitoring is to enhance students' capability in predicting their learning accurately. Previously, Bandura (1997) noted that the measurement of self-efficacy required to be improved into a specific construct. Similarly, Pajares & Schunk (2001) pointed out self-efficacy is more like a domain-specific or task-dependent construct.

Dimension of University Student Self-Efficacy

Table 1 describes the dimensions (constructs) of university student self-efficacy in science by different studies. Uzuntiryaki & Aydin (2008) noted that university student self-efficacy consisted of four dimensions: self-efficacy for knowledge/ comprehension level skills, self-efficacy for higher-order skills, self-efficacy for psychomotor skills, and self-efficacy for everyday applications. Seven years later, Lin *et al.* (2015a; 2015b) added one dimension called science communication and used the term "practical work" as self-efficacy for psychomotor skills. Suprapto & Chang (2015) also underlined the importance for adding self-learning strategy and self-assessment belong to the dimension. The main reason is many researchers explored the relationships between university students and their cognitive and metacognitive strategy use and science achievement. In terms of metacognitive, university students have self-learning strategy and self-assessment. As Zohar & Barzilai (2013) noticed that the field of metacognition in science education is in a state of development and expansion and that metacognition is increasingly incorporated into research addressing the core aims of science instruction.

The researchers underline the existence of scientific literacy as part of self-efficacy. This dimension is broken down from practical work. The skills relate to the experimental procedure (laboratory usage), which should be separated from interpreting data and making a report (scientific literacy). Finally, the dimensions of university student self-efficacy consisted of six dimensions in this research: Science Content (SC), Higher-Order Thinking (HOT), Laboratory Usage (LU), Everyday Application (EA), Science Communication (SCM), and Scientific Literacy (SL).

Table 1. The dimensions of university student self-efficacy in science by different studies.

Uzuntiryaki & Aydin (2009)	Lin et al. (2015a)	Lin et al. (2015b)	Suprapto & Chang (2015)	This research
Self-efficacy for knowledge/ comprehension level skills (SCS)	Conceptual Understanding	Conceptual Learning	Conceptual Understand-ing	Science Content (SC)
Self-efficacy for higher-order skills	Higher-order cognitive skills	Higher-order cognitive skills	Higher-order thinking skills	Higher-Order Thinking (HOT)
Self-efficacy for psychomotor skills (SPS)	Practical work	Practical work	Practical work	Laboratory Usage (LU)
				Scientific Literacy (SL)
Self-efficacy for everyday ap-plications (SEA)	Everyday application	Everyday application	Everyday application	Everyday Application (EA)
	Science communication	Science communication	Science communication	Science Communication (SCM)
			Self- Learning Strategy	
			Self-Assessment	

Research Aim

The aim of this research was to explore Indonesian university students' profiles in terms of their conception of learning physics and self-efficacy on learning physics. Given this position, the goals of this research were twofold:

1. To explore the conception of learning physics (CLP) and the physics learning' self-efficacy (PLSE) among different levels of students.
2. To examine the interrelationships among dimensions of conception of learning physics (CLP) and physics learning' self-efficacy (PLSE).

Methodology of Research

A quantitative survey was used in the research. The data gathered through research process to explore the comparison between Indonesian University students' conceptions of learning physics and their physics' self-efficacy. Starting from January to February 2015, the first author spread out the survey questionnaire to students in public universities, which have pre-service physics teachers (PSTs) program, in East Java province, Indonesia. Survey designs are procedures in quantitative research in which investigators administer a survey to a sample to describe the attitudes, the opinion, behaviors or characteristics of a population (Creswell, 2012).

Participants

As described in the introduction, the research focused on the fields of physics education. Originally, the first author spread out the questionnaire to 500 students from one university selected among three public universities, which have pre-service physics teachers program. All the three universities have similar levels and rank, therefore the participants were representative. The response rate in the research was 60% (302 students gave response). Among them, there were 279 university students (aged 18–23 years) who gave a complete response. In this research, the participants consisted mostly of female (43.4% male and 53% female). The number represented the ratio of students in a university who was dominated by females. In other words, the number illustrated the dominance of female in pre-service physics teacher in Indonesia. The sample varied of demographic factors, as shown in Table 2.

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Table 2. Summary of sample demographics (N= 279).

Background	Subtotal	
	n	%
Gender		
Male	121	43.4
Female	148	53.0
Missing	10	3.6
Level		
Freshman	75	26.9
Sophomore	70	25.1
Junior	72	25.8
Senior	52	18.6
Others	10	3.6
Missing	0	0
School background		
Natural Sciences	273	97.8
Social Sciences	1	.4
Linguistic	0	0
Others	3	1.1
Missing	2	.7
Total	279	100.0

Instruments and Procedures

Following guidelines by Lin *et al.* (2015a), the Conception of Learning Physics (CLP) and the Physics Learning Self-Efficacy (PLSE) questionnaires were developed. After getting permission to re-use and modify the instruments for research, the instruments were adapted and translated into Indonesian language. Originally, the instruments consisted of 20 items for CLP and 32 items for PLSE, which used English version. The two physics educators and one faculty member were then invited to review and to ensure the content validity of the CLP and the PLSE instrument in Indonesian version. The items of the two instruments were presented with bipolar strongly agree/strongly disagree statements in a five-point Likert mode. Accordingly, the participants achieving higher scores in a certain dimension expressed stronger agreement with the statements concerning the dimensions of CLP and PLSE.

Turning to CLP, the instrument consisted of three essential conceptions of learning, including understanding, calculating and practicing, and testing. Regarding the PLSE, the questionnaire consisted of six dimensions, including Science Content (SC), Higher-Order Thinking (HOT), Laboratory Usage (LU), Everyday Application (EA), Science Communication (SCM), and Scientific Literacy (SL). The items were coded on a five-point-Likert scale. The higher scores indicated better learning profile and greater self-efficacy. By translating process into Indonesian and by checking the content validity, the instrument feasible for Indonesian students. Finally, the CLP and PLSE consisted of 20 items and 30 items, respectively. The CLP still divided into three conceptions above. Meanwhile, the PLSE composed of six dimensions. In other words, we made some revisions compared to Lin *et al.* (2015a). The dimension of practical work was disparted into laboratory usage and scientific literacy due to scientific literacy is a wider perspective with other sub-scales stated in the curriculum (Özdem *et al.*, 2010; Holbrook & Rannikmae, 2007). The definition of each CLP and PLSE scales were efforted to accommodate the conception of learning physics, physics-related terms, and content in order to assess the students' physics learning self-efficacy. The detailed descriptions of the all dimensions are presented as follows:

Table 3. The dimensions of CLP and PLSE.

Dimension		Description
Conception of Learning Physics (CLP)	[¥]Understanding (UN, 7 items)	Measuring the university students' conception that learning physics is to understand the comprehensive meaning of physics knowledge.
	Calculating & Practicing (CP, 6 items)	Assessing the university students' conception that learning physics is viewed as a series of calculating and practicing tutorial problems, and manipulating formulae and numbers.
	[¥]Testing (TT, 7 items)	Measuring the university students' conception that learning physics is to achieve better performance on tests.
Physics Learning Self-Efficacy (PLSE)	*Science content (SC, 5 items)	Assessing the university students' confidence in their ability to use fundamental cognitive skills such as physics concepts, laws, or theories.
	Higher-order thinking skills (HOT, 5 items[§])	Assessing the university students' confidence in their ability to utilize sophisticated cognitive skills, including problem-solving, critical thinking, or scientific inquiry in the domain of physics.
	[¶] Laboratory usage (LU, 4 items[§])	Measuring the university students' confidence in their related capabilities to conduct physics experiments in laboratory activities.
	Everyday application (EA, 8 items)	Measuring the university students' confidence in their capability to apply physics concepts and skills in their daily life.
	Science communication (SCM, 5 items[§])	Assessing the university students' confidence in their ability to communicate or discuss physics-related content with classroom peers or others.
	[¶]Scientific literacy (SL, 3 items[§])	Assessing the university students' confidence in their ability to analyze and interpret data and to report the result of laboratory activities.

(Modified from Lin et al., 2015a; [¥], distinguishing in order of dimension; [*], changing the name of the dimension; [¶], new dimension; [§], changing the number of items)

Data Analysis

Analysis of data used SPSS's software that consisted of analysis of validity, exploratory factor analysis, and analysis of reliability by using Cronbach's α. However, the scale was used belong to interval data so this situation fulfilled the Brace *et al.* (2006) who noticed that for using factor analysis at least the variables should be the ordinal level of measurement. In general, both of the questionnaires were adopted from the fix instrument which had been translated into Indonesian language and validated through an exploratory factor analysis of participants' responses.

According to the validation criteria of exploratory factor analysis suggested by Stevens (2002), the retained items should preferably be weighted greater than .4. In other words, the items with a factor loading of less than .4 were deleted. Hereinafter, principal component extraction with a varimax rotation was conducted to estimate the number of factors proposed in this research, which contributed to the construct validity of each instrument (Suprapto, 2016). Furthermore, the Cronbach's alpha coefficient for each dimension of the CLP and PLSE instruments was calculated to ensure the reliability of each factor as well as the overall alpha coefficients of the two instruments. The information of validity and reliability for the scale is shown in Table 4 and Table 5. In addition, differences between student levels were also explored for their significance using an ANOVA test in order to portray a clear line among different conceptions of learning physics and physics learning self-efficacy in terms of student level. Subsequently, the Pearson product moment was used to measure the correlation among dimensions of conception of learning physics and the physics learning' self-efficacy.

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Table 4. The construct validities and reliabilities of the CLP questionnaire.

Factor (conception of learning physics)		Item	λ	%	α
Understanding (UN)	1	Learning physics allows me to solve or explain unknown questions and phenomena.	.76	19.38	.84
	2	Learning physics means understanding physics-related knowledge.	.66		
	3	Learning physics means understanding the connection between physics concepts.	.80		
	4	Learning physics is to realize the true meanings of physics theories and formulae.	.67		
	5	Learning physics enables me to understand physics-related questions and phenomena that I did not know in the past.	.67		
	6	Learning physics can expand my knowledge and vision.	.58		
	7	Learning physics makes me comprehend more phenomena and knowledge related to nature.	.71		
Calculating and Practicing (CP)	8	Learning physics involves a series of calculations and problem-solving.	.65	17.37	.83
	9	Learning physics means calculating and solving physics tutorial problems constantly.	.77		
	10	I think that learning calculation or problem-solving will help me improve my performance in physics courses.	.69		
	11	Learning physics means knowing how to use the correct formulae when solving problems.	.71		
	12	The way to learn physics well is to constantly practice calculations and problem-solving.	.72		
	13	There is a close relationship between learning physics, being good at calculations, and constant practice.	.66		
Testing (TT)	14	Learning physics means getting high scores on examinations.	.58	17.18	.82
	15	Learning physics is to answer examination questions correctly.	.66		
	16	If there are no tests, I will not learn physics.	.66		
	17	There are no benefits to learning physics other than getting high scores on examinations. In fact, I can get along well without knowing many physics facts.	.61		
	18	The major purpose of learning physics is to get more familiar with test materials.	.81		
	19	I learn physics so that I can do well on physics-related tests.	.75		
	20	There is a close relationship between learning physics and taking tests.	.76		
Overall				53.93	.79

λ, factor loading; α, reliability coefficient

Table 5. The construct validities and reliabilities of the PLSE questionnaire.

Dimension		Item	λ	%	α
Science Content (SC)	1	I can explain physics laws and theories to others.	.66	9.96	.78
	2	I can choose an appropriate formula to solve a physics problem.	.77		
	3	I can link the contents among different physics concepts and establish the relationships between them.	.50		
	4	I know the definitions of basic physics concepts very well.	.68		
	5	I feel confident when I interpret graphs/charts related to physics.	.67		
Higher-Order Thinking (HOT)	7	I am able to design physics experiment to verify my hypothesis.	.55	9.26	.68
	8	I am able to propose many viable solutions to solve a physics problem.	.57		
	9	When I come across a physics problem, I will actively think over it first and devise a strategy to solve it.	.54		
	10	I am able to make systematical observations and inquiry based on a specific physics concept or scientific phenomenon.	.73		
	11	When I am exploring a physics phenomenon, I am able to observe its changing process and think of possible reasons behind it.	.51		
Laboratory Usage (LU)	12	I know how to carry out experimental procedures in the physics laboratory.	.75	10.74	.82
	13	I know how to use equipment in the physics laboratory.	.74		
	15	I know how to set-up equipment of laboratory experiments.	.74		
	16	I know how to collect data during the physics laboratory.	.62		
Everyday Application (EA)	19	I am able to explain everyday life by using physics theories.	.65	10.52	.78
	20	I am able to propose solutions to everyday problems by using physics.	.62		
	21	I can understand the news/documentary I watched on television related to physics.	.67		
	22	I can recognize the careers related to physics.	.48		
	23	I am able to apply what I have learned in school physics to daily life.	.67		
	24	I am able to use scientific methods to solve physics problems in everyday life.	.46		
	25	I can understand and interpret social issues related to physics in a scientific manner.	.42		
	26	I am able to aware that a variety of phenomena in daily life involve physics –related concepts.	.51		
Science Communication (SCM)	27	I am able to comment on presentations made by my classmates in physics class.	.73	8.57	.78
	28	I am able to use what I have learned in physics classes to discuss with others.	.72		
	29	I am able to clearly explain what I have learned to others.	.72		
	30	I feel comfortable to discuss physics content with my classmates.	.65		
	32	In physics classes, I can express my ideas properly.	.44		
Scientific Literacy (SL)	14	I can interpret data during the laboratory sessions.	.56	7.03	.75
	17	I can write a laboratory report to summarize main findings.	.65		
	18	I am confident that I could analyze a set of data from the physics laboratory.	.73		
Overall				56.08	.91

λ, factor loading; α, reliability coefficient

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Results of Research

Exploratory Factor Analysis of CLP and PLSE

In conducting a factor analysis, the first set of factor loadings is obtained by using a method that permits convenient calculation of the loadings (Crocker & Algina, 1986). These sets of factor loadings are called initial or unrotated loadings. In this case, it was used the rotated loading to approximate simple structure. In other words, a varimax rotation was used to gain principal component extraction. For CLP instrument (Table 4), after extracting three factors, by conducting EFA (Exploratory Factor Analysis) with varimax rotation, checking eigenvalue and loading factor and following by analyzing of internal consistency of factor structure, 20 items were included. The Kaiser–Meyer– Olkin (KMO) value was .83 and the result of Bartlett's test was significant ($\chi^2 = 2138.64$, $df = 190$, $p < .001$), indicating that the samples were appropriate for factor analysis. Table 4 also shows the construct validities and reliabilities of the physics learning profile questionnaire. The three factors accounted for 53.93% of the total variance. Factor loading of physics learning profiles designed to measure each factor was between .58 and .81, with Cronbach's α coefficients for these factors were .84, .83, .82, respectively, and the overall alpha value was .79. It was suggesting that these factors had high internal consistency for assessing the university students' three conceptions of learning physics and were suitable for further exploration of the university students' physics learning profiles.

For PLSE instrument, by following the same way with CLP instrument resulted the Kaiser–Meyer– Olkin (KMO) value was .87 and the result of Bartlett's test was significant ($\chi^2 = 2833.18$, $df = 435$, $p < .001$), indicating that the samples were appropriate for factor analysis. Table 5 shows the construct validities and reliabilities of the Physics Learning Self-Efficacy questionnaire. The six factors accounted for 56.08% of the total variance. Factor loading of the Physics Learning Self-Efficacy designed to measure each factor were between .42 and .77, with Cronbach's α coefficients for these factors were .78, .68, .82, .78, .78, .75, respectively, and the overall alpha value was .91. It was signifying that these factors had high internal consistency for assessing the university students' six factor of self-efficacy, and were suitable for further exploration of the university students' physics self-efficacy. Nevertheless, Item 6 (I am able to critically evaluate the solutions of physics problems) and item 31 (In physics classes, I can clearly express my own opinions) were deleted because the items with a factor loading of less than .4.

Conception of Learning Physics (CLP) among Different Levels

Table 6 depicts the comparison of conception of learning physics among different levels in the university. Based on ANOVA test, only the conception of testing performed significantly different among university students at different levels. Therefore, from post hoc test (Scheffé test) indicated that university students who studied more than four years (others) (M=2.98, SD=.33) stated better in testing than others. In contrast, Sophomore level based on their scores on the conceptions of testing was significantly lower than the scores of the other levels (M=2.46, SD=.63). Meanwhile, the conception of understanding (UN) and calculating and practicing (CP) were not significantly different.

Table 6. The comparisons of the Conception of Learning Physics among different levels in the university.

Level	Understanding- UN (mean, SD)	Calculating and Practicing-CP (mean, SD)	Testing-TT (mean, SD)
Freshman (1)	3.70 (.56)	3.63(.57)	2.74(.64)
Sophomore (2)	3.87 (.41)	3.53(.61)	2.46(.63)
Junior (3)	3.88(.51)	3.42(.66)	2.54(.65)
Senior (4)	3.93(.51)	3.62(.59)	2.77(.72)
Others (5)	4.01(.33)	3.92(.42)	2.98(.33)
Total	3.84(.50)	3.56(.61)	2.63(.66)
F (ANOVA)	2.34	2.19	3.53*
Post hoc test (Scheffé tests)	-	-	5>2, 5>4>1>3>2

* *p* < .05

Table 7. The comparisons of Physics Learning Self-Efficacy among different levels in university.

Level	Science Content-SC (mean, SD)	Higher-Order Thinking- HOT (mean, SD)	Laboratory Usage- LU (mean, SD)	Everyday Application- EA (mean, SD)	Science Communication-SCM (mean, SD)	Scientific Literacy-SL (mean, SD)
Freshman (1)	3.23(.43)	3.12(.38)	3.68(.56)	3.26(.37)	3.41(.44)	3.50(.57)
Sophomore (2)	3.34(.57)	3.26(.46)	3.70(.49)	3.33(.49)	3.34(.49)	3.63(.50)
Junior (3)	3.30(.47)	3.38(.47)	3.77(.58)	3.46(.41)	3.50(.53)	3.57(.56)
Senior (4)	3.53(.51)	3.33(.59)	3.74(.59)	3.52(.44)	3.74(.52)	3.69(.65)
Others (5)	3.36(.42)	3.46(.48)	4.00(.54)	3.48(.28)	3.94(.44)	3.77(.42)
Total	3.34(.50)	3.28(.48)	3.73(.55)	3.38(.43)	3.50(.51)	
F (ANOVA)	2.962*	3.304*	.873	3.951**	7.543***	1.188
Post hoc test (Scheffé tests)	4>1, 4>5>2>3>1	3>1, 5>3>4>2>1	-	4>1, 4>5>3>1>1	4>1>2, 5>1>2, 5>4>3>2>1	-

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.001$

The Physics Learning Self-Efficacy (PLSE) among Different Levels

Table 7 illustrates the comparison of Physics Learning Self-Efficacy among different levels at university. Based on ANOVA test, it was found a significantly different among levels in terms of science content, higher-order thinking, everyday application, and science communication. In contrast, it showed no significantly different among university students in different level in terms of laboratory usage and scientific literacy. Therefore, from post hoc test (Scheffé test) indicated that university students as pre-service teachers in senior level performed higher confident in science content, everyday application, and science communication. However, students who lived more than four years at university indicated higher confidence in higher-order thinking and science communication than others.

The Correlation among Dimensions of CLP and PLSE

Table 8 depicts the relationships among dimensions of conception of learning physics and physics learning self-efficacy. In general, the correlation coefficients were significantly positive, ranging from .14 to .58 for all dimensions both CLP and PLSE, except the dimension of testing and other dimensions, (such as science content, science communication, laboratory usage, everyday application, and scientific literacy) were accounted a negative correlation. The coefficient range was useful for moderate prediction based on the criteria of Creswell (2012). Specifically, the intra-relationship among dimensions of CLP indicated that there was a significant correlation between dimension (calculating-practicing and understanding) and (calculating-practicing and testing). Conversely, there was a significant negative correlation between understanding and testing. Meanwhile, the intra-relationship among dimensions of PLSE showed that all of the dimensions had significantly correlation each other at α=.01.

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Table 8. The correlation among dimensions of CLP and PLSE.

	Dimension	1	2	3	4	5	6	7	8	9
1	Understanding (UN)	-								
2	Calculating and Practicing (CP)	.37**	-							
3	Testing (TT)	-.15*	.16**	-						
4	Science Content (SC)	.22**	.06	-.02	-					
5	Science Communication (SCM)	.38**	.14*	-.01	.38**	-				
6	Higher-Order Thinking (HOT)	.35**	.09	.02	.52**	.37**	-			
7	Laboratory Usage (LU)	.34**	.20**	-.15*	.25**	.33**	.32**	-		
8	Everyday Application (EA)	.42**	.18**	-.09	.45**	.44**	.57**	.42**	-	
9	Scientific Literacy (SL)	.36**	.14*	-.07	.34**	.37**	.40**	.58**	.40**	-

* $p < 0.05$ ** $p < 0.01$

Discussion

For conducting exploratory factor analysis, there are two essential points (Suprapto & Chang, 2015; Suprapto & Ku, 2016), including stability data and factor structure. *First*, for survey study, the most item parameter can be estimated by relative stability for samples of 200 participants, and so that it might consider the minimum number desired (Crocker & Algina, 1986). *Second*, several criteria for conducting data analysis in self-efficacy scale: a) exploratory factor analysis was employed to attain the factor structures of the two adopted instruments based on the participants' responses on the instruments; b) the condition for factor extraction was based on a combination of Kaiser's criterion of eigenvalue larger than 1 confirming the intended factor structure; c) the retained items should preferably be weighted greater than .4 as stated by Stevens (2002); and d) the factor should explain at least 50% of the variance among all extracted factors.

Based on the results, the two instruments used in this research had satisfactory validity and reliability. The overall percentage of variance extracted (53.93% for CLP and 56.08% for PLSE) supported the assertion that all factors were deemed sufficient and conceptually valid in their correspondence to the existing theory. All items had pattern coefficients higher than .4, which was suggested to be satisfactory by Stevens (2002). After a careful investigation of the content of those items, some items listed above were deleted. The deleted item was considered to be too general to assess self-efficacy as opposed to Bandura's suggestion mentioned earlier. In Lin's *et al.* (2015a) research, the overall percentage of variance accounted (65.74% for CLP and 65.60% for PLSE). However, the main difference between the two studies is the number of dimensions, especially on PLSE. The authors added "scientific literacy" and distinguished with "laboratory usage" in terms of "practical work" in Lin *et al.*'s (2005a) study.

Regarding the result of ANOVA test, only the conception of testing (TT) performed significantly different ($\alpha = .05$) among university students in different levels. University students who lived more than four years stated better in testing of physics than others as well as senior levels. In contrast, Sophomore levels on the conceptions of testing were significantly lower than the scores of the other level. After finishing general courses in their first year, they already focused on the physical and pedagogical content in the second year. Meanwhile, the conceptions of calculating and practicing (CP) and understanding (UN) were not significantly different. In Lin *et al.*'s (2015a) research, all the dimensions of conception of learning physics performed significantly different among the cluster participants. Their research separated the participants into three clusters: reproductive, transitional, and constructive.

Turning to the physics learning self-efficacy, there was a significant difference among levels in terms of science content, higher-order thinking, everyday application, and science communication. In contrast, there was no significant difference among university students in different levels in terms of laboratory usage and scientific literacy. Student in senior level gained more experience and knowledge in physics. Therefore, their performed well in those dimensions were compared to others. In-line with Thomas (2013), students' comprehensive understanding of scientific knowledge by using deep learning strategies learners may influence on attaining meaning and perform higher-order cognitive processing. Students who view physics learning as understanding may frequently achieve higher-order forms of learning and gain self-efficacy in their ability to use higher-order scientific approaches.

Considering the laboratory usage, there was no significant difference among university students at different levels. It can be understood that the prospective physics teachers can't be separated from laboratory activities ranging from first year to fourth year based on the formal curriculum in Indonesia. The participants do believe that the activities like carrying out experimental procedures in the physics laboratory, setting-up equipment of laboratory experiments, and collecting data during the physics laboratory have the same pattern ranging from a basic experiment to advanced experiment. Then, the research also indicated that there were no differences among university students in different levels in terms of scientific literacy. The explanation can be proposed that the activities, such as interpreting, analyzing, and reporting data are the major goal of science education. Özdem *et al.* (2010) argued that scientific literacy should be examined with a broader perspective, including the nature of science (NOS) and scientific concept knowledge (SCK) in the curriculum. Moreover, Holbrook & Rannikmae (2007) underlined the meaning of NOS to enhance scientific literacy. Therefore, the teaching approach for science education should be regarded as education through science, rather than science through education. This approach gives implication for the importance of the enhancement of multidimensional scientific literacy for science learning.

The relationships among dimensions of conception of learning physics and physics learning self-efficacy were significantly positive for all dimensions. The intra-relationship among dimensions of CLP indicated that there was a significant correlation between dimension (calculating-practicing and understanding) as well as (calculating-practicing and testing). In contrast, it was indicated a negative correlation between understanding and calculating-practicing. Meanwhile, the intra-relationship among dimensions of PLSE showed that all of the dimensions have significant correlation with each other at $\alpha = .01$. This situation in-line with Uzuntiryaki & Aydin (2008); Lin *et al.* (2015a); Lin *et al.* (2015b); and Suprapto & Chang (2015) who derived the dimension of physics learning self-efficacy.

Furthermore, the relationships between the dimension of CLP and PLSE presented varying results. There was no relationship between the dimension of testing (part of CLP) and all other dimensions, except laboratory usage (LU) with coefficient of correlation -.15. The result confirmed to us that the importance of including the dimension as emphasized by Suprapto & Chang (2015) who underlined the importance for adding self-learning strategy and self-assessment belong to the dimension of self-efficacy due to testing and self-assessment are closely related. Moreover, there was a significant correlation between the dimension of CLP: understanding and all of dimensions of PLSE at $\alpha = .01$. Nevertheless, for the dimension of calculating and practicing (CP) correlated with laboratory usage (LU) and everyday application (EA) at $\alpha = .01$ as well as science communication (SCM) and scientific literacy (SL) at $\alpha = .05$. Similarly, Uzuntiryaki & Aydın (2009) stated that correlational studies should be conducted to investigate the relationship between self-efficacy beliefs and other variables such as self-regulatory skills in calculating and practicing.

Conclusions and Implications

The research was designed to explore the university students' conception of learning physics and the university students' physics learning self-efficacy. There was a moderate correlation among dimensions of conception of learning physics and physics learning' self-efficacy. Based on their levels, students in the Sophomore level were significantly lower than the scores of the other levels on the conceptions of testing. There was a significant difference among levels in terms of science content, higher-order thinking, everyday application, and science communication. In contrast, there was no significant difference among university students in different levels in terms of laboratory usage and scientific literacy. In this context, university students as prospective teachers in senior-level performed higher confident in science content, everyday application, and science communication. However, students who studied more than four years in university indicated higher confidence in higher-order thinking and science communication than others.

Finally, this research had some limitations and implications. Even though the questionnaires used in this research have been modified, but they still needed for further validation. From a research viewpoint, the CLP and PLSE can be used in several ways, for example, to predict students' readiness for physics learning and to give any information about students' capacity to become physics teachers. Researchers can investigate the relationship among students' self-efficacy beliefs, learning motivation, self-regulatory skills, and academic achievement. The authors also think the possibility of reviewing the dimensions of understanding in CLP and science content in PLSE due to both of the two dimensions have similar constructs. The dimension of understanding assesses the university students' confidence in their ability to use fundamental cognitive skills such as physics concepts, laws, or theories.

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On the other hand, the dimension of science content measures the university students' conception that learning physics is to understand the comprehensive meaning of physics knowledge.

In the present research, data are collected from university students on four levels taking physics class at a single point in time. Physics self-efficacy beliefs can also be studied longitudinally through their progress in the university in order to monitor changes in efficacy beliefs. The possible question for future research, (i.e. How do the developments of self-efficacy beliefs of university students change through the years?). In addition, the factors affecting the development of self-efficacy also can be explored. The PLSE also can be distributed as a pre-test and post-test in an experimental setting to compare different instructional methods. It is also important to consider the predictive ability of the sources of self-efficacy for different gender in physics. In this research, the majority of participants are female. It is important to compare and to explore the students' conception of learning physics and their self-efficacy when either male > female or female > male. However, by reviewing the pros and cons of this research, the implications drawn contribute to the improvement of the physics teacher education program in Indonesia.

Note

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