Self-Efficacy: Its Correlation to the Scientific-Literacy of Prospective Physics Teacher

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Abstract. The low number of scientific literacy in education is still one of the learning’s problems in Indonesia. From the results of The Programme for International Student Assessment (PISA) in 2015, Indonesia still gets a low average, which is 403 with the average score of all countries is 500. Some research in Indonesia says that internal factors such as Self Efficacy very influential for someone’s scientific literacy ability. The purpose of this study was to analyze the level of self-efficacy of prospective physics teachers and its relation to scientific literacy of prospective physics teachers. The instruments of the research that used were objective-tests with multiple-choice and multilevel-reasons. The correlation test used is Pearson formula in Microsoft Excel program with correlation result $r_{count} > r_{table}$ that is $0.80 > 0.27$ with the high category, and the result of $t_{count} > t_{table}$ is significance. So it can be concluded that self-efficacy has a high relationship, positive and significant to scientific literacy.

1. Introduction
The expected output of science learning is that students can understand and apply a concept of learning in everyday life [1]. In educational terms, this ability is known as scientific literacy.[2]. Scientific literacy skills of students in Indonesia are still very lacking, even in the international arena science literacy skills of Indonesian students touch below the average [3] proven by the results of the score in the Program for International Student Assessment (PISA) held every 4 years [4], Indonesia has never touched the above average, namely in 2006, 2009, 2012 and 2015 scored 395, 383, 382 and 403 [5] with an average score of all countries is 500 [6].

Various measures are taken to improve scientific literacy, such as the application of different learning methods and models in several studies it has been reported that these methods are successful, as in Sari Wulan Diana’s research which proves that the Peer Assisted Learning (PAL) strategy has a significant effect on Student Scientific Literacy Ability [7]. In another study aimed at developing guided inquiry-based science learning materials to improve scientific literacy prospective MI teachers also showed effective results. [5] However, there are other studies that apply the same learning model or method in different places that actually show the opposite result. As in the research of R. Ahmad Zaky El Islami which suggested that there were no significant differences in the improvement of students’ scientific literacy when given treatment in the form of guided inquiry learning [8].

Ekohariadi in 2009 in his study surprisingly explained that there is a negative relationship between scientific literacy and teaching and learning strategies, important factors that influence scientific literacy actually arise from attitudes toward science, such as the level of self-efficacy, interest, and
curiosity about science [9]. Self-efficacy or commonly referred to as self-confidence is a person's confidence in his ability to organize, control, and carry out a series of behaviors to achieve the desired outcome that can affect a person's activity. [4, 9–17].

Based on Jäppinen’s research, the secret of the success of Finnish students in achieving the best scientific literacy achievements in PISA is the factor that comes from the teacher, the same thing with the success of Japanese students in scientific literacy in Trends in the International Mathematics and Science Study (TIMSS) is also a factor derived from teachers [18–23]. The teacher said in Javanese terms has the term "digugu" and "ditiru" which means that good teacher competence can create good quality education [25–26]. Based on some of the statements above, it can be concluded that the teacher's scientific literacy abilities will greatly influence the scientific literacy skills of students. Therefore scientific literacy is a very important ability to be mastered by educational students as prospective Physics teachers in Indonesia.

The new things that distinguish this research with its previous are that in this study the researcher analyzed the self-efficacy of each domain and presented the data with quantitative descriptive method then proceeded to find the correlation between self-efficacy and scientific literacy. In addition, in the measurement of scientific literacy, the authors developed instruments based on 3 cognitive domains in scientific literacy and made objective instruments with multiple choice answers and reasons in the form of multilevel entries that had never been carried out by previous researchers.

2. Methods

This research is a quantitative research with the quantitative descriptive type which aims to describe the level of Self-efficacy of prospective physics teacher [27] and correlation methods to find the relationship between self-efficacy and scientific literacy [27–30]. The prospective physics teacher referred to in this study are students who are studying in the physics education program at the State University in Lampung. This research was conducted in universities that have physics education majors in Lampung, that is State Islamic University Raden Intan Lampung and the University of Lampung. The sample selection in this study used purposive sampling technique, with the reason for curriculum inequality between the two universities, so that the same courses and semesters were sought in both universities. In this case, a sample of 2nd-semester students from each university was obtained.

The instrument in this study consisted of the test and non-test instruments (questionnaire) [2]. Self-efficacy in this study was measured using a Likert scale questionnaire which was adopted from the development of Hairida's self-efficacy instrument [26] by eliminating the 3rd scale (hesitation) so that the respondent can give a firm and impartial answer [20].

Scientific literacy is measured using multiple choice objective tests accompanied by multilevel reasons, consisting of 8 items because the original version of this objective test is a plural choice, it is necessary to modify it to produce multiple-choice instruments with multilevel reasons. Instruments that have been made are then validated by 3 expert validators [30] and then tested for validity, reliability, difficulty level test, discriminating power and distraction test for multiple choices.

To determine the level of self-efficacy, it was tested using a Likert scale questionnaire with the scoring shown in table 1:

| Question | SS | S | TS | STS |
|----------|----|---|----|-----|
| Positive | 5  | 4 | 2  | 1   |
| Negative | 1  | 2 | 4  | 5   |

After the score is collected, it is calculated using the percentage formula:

\[
\text{Presentase} = \frac{n}{N} \times 100\%
\]
With:
\( n \) = number of student answer scores
\( N \) = number of maximum scores

Interpretation of self-efficacy in this study is presented in very high, high, quite high, low, and very low criteria [9] it is presented in table 2 below:

| Interval     | Kriteria   |
|--------------|------------|
| 80% - 100%   | Very High  |
| \( \geq 60\% \) | High       |
| \( \geq 40\% \) | Quite High |
| \( \geq 20\% \) | Low        |
| \( < 20\% \)  | Very Low   |

Analysis of the level of self-efficacy in this study is presented in quantitative descriptive form in the form of tables and charts. The results of scientific literacy from the tests that have been done by prospective teachers are then calculated by the equation:

\[ \text{Presentase} = \frac{n}{N} \times 100\% \]

With:
\( n \) = number of student answer scores
\( N \) = number of maximum scores

The interpretation of scientific literacy in this study is presented in the criteria of excellent scientific literacy levels, good scientific literacy, insufficient scientific literacy, lack of scientific literacy and very lack scientific literacy. [8] as presented in Table 3 below:

| Nilai          | Kriteria        |
|----------------|-----------------|
| LS \( \geq 80\% \) | Excellent       |
| 66% \( \leq \) LS < 80% | Good          |
| 56% \( \leq \) LS < 66% | Enough        |
| 40% \( \leq \) LS < 56% | Lack          |
| LS < 40%       | Very Lack       |

Before the correlation test was carried out, a prerequisite test was performed with normality, homogeneity and linearity tests. The data of the correlation between Self Efficacy and scientific literacy ability of prospective physics teacher were analyzed by \( r \) correlation by Pearson to determine the correlation index between the level of Self Efficacy with students’ scientific literacy skills. The data analysis method used in this study was Product Moment correlation, calculated using Microsoft Excel 2007. The significance test is carried out using t-test:

\[ t_{hitung} = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} \]

After \( t_{hitung} \) is obtained, then the results of \( t_{hitung} \) are matched with the provisions of the significance test as follows:
1) If \( t_{hitung} > t_{table} \) then \( H_0 \) is rejected (there is a significant correlation)
2) If \( t_{hitung} < t_{table} \) then \( H_0 \) is accepted (there is no a significant correlation)
3. Results and Discussion

The researcher presents the recapitulation of the results of the self-efficacy test of the students of UIN Raden Intan Lampung and the University of Lampung in the following tables 4 and 5:

**Table 4. Self Efficacy Results of UIN Raden Intan Lampung**

| Dimension: Magnitude |       |         |
|----------------------|-------|---------|
| Average              | 45.64 | 50.71%  |
| Maximum Score        | 88    | 97.78%  |
| Minimum Score        | 14    | 15.56%  |

| Dimension: Strength  |       |         |
|----------------------|-------|---------|
| Average              | 54.68 | 47.55%  |
| Maximum Score        | 104   | 90.43%  |
| Minimum Score        | 31    | 26.96%  |

| Dimension: Generality|       |         |
|----------------------|-------|---------|
| Average              | 22.24 | 49.42%  |
| Maximum Score        | 39    | 86.67%  |
| Minimum Score        | 8     | 17.78%  |

| Self Efficacy        |       |         |
|----------------------|-------|---------|
| Average              | 122.68| 49.07%  |
| Maximum Score        | 225   | 90.00%  |
| Minimum Score        | 60    | 24.00%  |

**Table 5. Self Efficacy Results of University of Lampung**

| Dimension: Magnitude |       |         |
|----------------------|-------|---------|
| Average              | 66.32 | 73.69%  |
| Maximum Score        | 85    | 94.44%  |
| Minimum Score        | 42    | 46.67%  |

| Dimension: Strength  |       |         |
|----------------------|-------|---------|
| Average              | 81.64 | 70.99%  |
| Maximum Score        | 97    | 84.35%  |
| Minimum Score        | 61    | 53.04%  |

| Dimension: Generality|       |         |
|----------------------|-------|---------|
| Average              | 30.72 | 68.27%  |
| Maximum Score        | 39    | 86.67%  |
| Minimum Score        | 22    | 48.89%  |

| Self Efficacy        |       |         |
|----------------------|-------|---------|
| Average              | 178.64| 71.46%  |
| Maximum Score        | 205   | 82.00%  |
| Minimum Score        | 128   | 51.20%  |

Based on tables 4 and 5, the average score, maximum scores and minimum scores of physics education students at both universities are seen. In the measurement of Self Efficacy of Physics Education students (prospective physics teacher) from UIN Raden Intan Lampung, the average level of magnitude dimension was 50.71% (quite high). While the measurement of self-efficacy of Physics Education students (prospective physics teachers) at the University of Lampung has a percentage of 73.69% (high). The magnitude dimension of self efficacy is defined as the level of confidence in overcoming learning and task difficulties [31], so as it can be concluded that prospective physics teacher from UIN Raden Intan Lampung has a sufficient level of confidence in overcoming learning difficulties and task difficulties, and prospective physics teacher from University of Lampung has a high level of confidence in overcoming learning difficulties and task difficulties.
Judging from the level of confidence in learning and completing tasks (strength dimension) the presentation of the average physics teacher candidates from UIN Raden Intan Lampung is 47.55\% (enough) with the highest score is 90.43\% and the lowest score is 26.96\%. The average presentation obtained by prospective physics teacher from the University of Lampung is 70.99\% (high) with the highest score is 84.35\% and the lowest score is 53.04\%. Based on tables 4 and 5 above, it can be seen that the highest score on the strength dimension obtained by the respondents of UIN Raden Intan Lampung is greater than the highest score of University of Lampung respondents, but the level of strength with the minimum score achieved by the respondent of UIN Raden Intan Lampung is far below minimum score of respondent from Lampung University. In this regard, it can be concluded that at the level of confidence in learning and completing tasks (strength), even though some prospective teachers have demonstrated their ability to learn and complete very high tasks, most of the physics teacher candidates from UIN Raden Intan Lampung still tend to feel less confident in its ability to learn and complete Physics tasks, so that it can affect the performance of candidates in learning (as students) and doing assignments. Whereas the average of prospective physics teacher from Lampung University has a high level of confidence (70.99\%) of his ability. It has a very good effect on their performance in learning or doing assignments.

Furthermore in the generality dimension which refers to the flexibility of one's self-efficacy in all forms of situation, the prospective physics teacher from UIN Raden Intan Lampung gets an average of 49.42\%, which is quite high category, while the prospective physics teacher at the University of Lampung gets an average larger, it is 68.27\% with high category. The highest generality level obtained by prospective physics teachers from UIN Raden Intan Lampung and the University of Lampung shows the same number of 86.67\%, and for the lowest generality level of the prospective teacher from UIN Raden Intan, Lampung is very low, amounting to 17.78\% for prospective physics teachers the University of Lampung is 48.89\%. The dimension of generality shows the level of prospective teachers’ self-efficacy towards their ability to understand subjects and work on problems when faced an unusual situation, such as when they have to understand the concepts without the guidance of the lecturers. Self-efficacy is a self-confidence assessment of how well individuals can take the necessary actions related to a prospective situation. In this case, self-efficacy is the self-confidence of physics education students as prospective physics teacher on their ability to learn and complete physics tasks. The level of prospective physics teachers’ self-efficacy of UIN Raden Intan Lampung through this research is known as 49.07\%. This figure reveals that the average level of self-efficacy of prospective physics teachers at UIN Raden Intan Lampung has quite high confidence in their own ability in learning and doing tasks in any situation. The level of self-efficacy of prospective physics teacher at the University of Lampung through this research is known as 71.46 \%. This means that students of physics education (candidates for physics teachers) at the University of Lampung have confidence in their high ability to learn and do assignments in any situation. The comparison between Self Efficacy Results of Physics Education Student (Prospective Physics Teacher) in UIN Raden Intan Lampung and University of Lampung can be seen from chart 1 below:

Chart 1 Self Efficacy Results of Physics Education Student (Prospective Physics Teacher) in UIN Raden Intan Lampung and University of Lampung
The level of self-efficacy of physics education students of UIN Raden Intan Lampung through this research is known to be an average of 49.07%. This means that the average level of self-efficacy of physics education students in the second semester of UIN Raden Intan Lampung has confidence in their own high ability in learning and doing assignments in any situation.

The level of self-efficacy of students of physics education at the University of Lampung through this study is known to have an average of 71.46%. This means that the average level of self-confidence in physics students in the second semester of Lampung University has confidence in their high self-ability in learning and doing assignments in any situation.

The results of scientific literacy of physics education students at UIN Raden Intan Lampung and University of Lampung can be seen on chart 2 below:

**Chart 2 Scientific Literacy of Physics Education Student (Prospective Physics Teacher) in UIN Raden Intan Lampung and University of Lampung**

Chart 2 shows quantitative data that shows the average, maximum and minimum scores of students' scientific literacy abilities, which then after being matched with the scientific literacy criteria table shows that the average of scientific literacy ability of class C physics education students at UIN Raden Intan Lampung is still at Very lack level of 35.72%, and the average scientific literacy ability of students of physics education class B at the University of Lampung was 72.06% at a good level.

Students’ Self Efficacy and Scientific Literacy correlation in this study were calculated with Pearson and corral formulas to get r correlation, which then got the results as shown in Table 6 below:

**Table 6 Correlation Test Result**

| Formula | R_t | R_h | Conclusion | Criteria |
|---------|-----|-----|------------|----------|
| Pearson | 0.27 | 0.80 | H_0 is rejected | (High) |
| correl  | 0.27 | 0.80 | H_0 is rejected | (High) |

Based on the data above, it can be seen that Self Efficacy has a strong (high) positive relationship to scientific literacy. This can be seen from the results of the research that shows the higher Self Efficacy of a student (prospective teacher), the scientific literacy skills of prospective teachers also tend the higher it is. This result is in accordance with Ekohariadi’s statement in his research which states that self-efficacy is an internal factor that influences the level of scientific literacy ability [26], [33]. The significance test in this study was done by t-test and get the results:

**Table 7 Significance Test Result**

| Table | \( t_{\text{table}} \) | \( t_{\text{count}} \) | Conclusion |
|-------|-----------------|-----------------|------------|
| \( t_{\text{table}} \) | 2.008559072     | 12.96531176    | \( t_{\text{count}} > t_{\text{table}} \) |
| Conclusion | \( H_0 \) is rejected (there is a significant correlation) |
Based on the results of the significance test, it can be seen that the relationship between Self Efficacy and scientific literacy is a significant correlation. This is also in line with Temu Riyadi's research which states that self-efficacy has a positive, strong and significant correlation to scientific literacy [34].

4. Conclusion
This study concludes that there is a positive and significant correlation between the level of self-efficacy and scientific literacy ability of prospective physics teachers.

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