LNU Pre-service Secondary Science Teachers’ Scientific Literacy and Science Teaching Self-Efficacy

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Abstract. The main purpose of this study is to determine Leyte Normal University’s pre-service secondary science teacher’s scientific literacy and science teaching self-efficacy. Further, the relationship between scientific literacy and science teaching self-efficacy is explored. Participants were 50 fourth-year students enrolled in the BSEd Biological Science program. The survey method was used in this study. The participants’ science teaching self-efficacy was determined by Science Teaching Efficacy Belief Instrument (STEBI-B) developed by Enochs and Riggs (1990), while scientific literacy was measured by Test of Basic Scientific Literacy (TBSL). The results showed that the pre-service teachers’ science teaching self-efficacy is at the medium level. Further, participants had satisfactory scientific literacy levels. The Pearson product–moment correlation revealed a moderately positive relationship between scientific literacy and science teaching self-efficacy.

1. Introduction

The overarching goal of reforms in the field of Science Education is the development of scientifically literate individuals equipped with the necessary abilities to embrace developments and live in an utterly dynamic society. Countries around the globe invest in the furthering of Science instruction because of the apparent and undeniable impact of Science on progress. The success of the various efforts and reforms set forth to improve quality of Science Education rests on a number of factors. They form part of the core of educational systems and their roles cannot be undermined. For this reason, educational reforms are done in the past, which did not consider teacher characteristics and involvement, failed [1-3].

Teachers serve a pivotal role in the development of scientific literacy among learners across levels of educational systems. To successfully effect scientific literacy, they too shall have developed scientific literacy in themselves. Scientific literacy speaks of knowledge and understanding of the fundamental scientific ideas and processes that are necessary for personal decision making, involvement both civic and cultural affairs, as well as economic productivity [4-5]. Related studies agree that teachers, both pre-service and in-service, with low scientific literacy cannot be expected to develop and produce scientifically literate learners.
The success of educational reforms is also contingent on the development of influential self-efficacy among teachers [6]. In the study of [7], results revealed that those teachers who lack confidence in their capability to bring about success in the classroom tend to focus on the not so good features of the classroom and are consequently unable to teach effectively. More studies support the idea that teachers with a relatively higher self-efficacy exhibit inclination towards utilization of cooperative and child-centered learning strategies while this with lower self-efficacy tends to employ the traditional teacher approach.

People with low level skills and knowledge may have illusory superiority and mistakenly assess their ability to accomplish a task as greater than it is. On the other hand, those with higher level skills have the predisposition to underestimate their ability to perform a task [8-10]. Cognitive biases exemplified in the Dunning-Kruger effect must be given consideration in teacher training institutions. The interplay between self-efficacy and scientific literacy must be underscored for it has a profound bearing on what teachers believe, decide on, and do [11-13].

Based on the foregoing arguments, it is the intent of this study to determine the scientific literacy and science teaching self-efficacy of the preservice secondary science teachers of Leyte Normal University. Also, this study explored the relationship between scientific literacy and science teaching self-efficacy. There is an utter lack of studies exploring the relationship between scientific literacy and science teaching self-efficacy [14-16].

2. Methodology

2.1 Design
This study made use of the of the descriptive survey design. Descriptive survey research is used for gathering primary data based on either or both verbal and written communication with respondents. Further, descriptive research is geared towards collection of relevant information about prevailing conditions for the purpose of description and interpretation.

2.2 Respondents
Participants in the study were 50 fourth-year students enrolled in the Bachelor of Secondary Education (BSEd) – with specialization in Biological Sciences program of Leyte Normal University for the school year 2017–2018. Completion of the academic courses required for the programs as well as deployment in schools for practice teaching serves as the eligibility criteria for inclusion in the study.

2.3 Data Collection and Instrument
There were two data collection instruments used in this study - Test of Basic Scientific Literacy (TBSL) and Science Teaching Efficacy Belief Instrument (STEBI-B).

The test comprises 110 items spread across six TBSL scales. The scales with the corresponding number of items are as follows: Nature of Science (22 items), Science Content Knowledge (72 items), and Science Technology and Society (16 items). To be considered minimally scientifically literate, a total score of 68 must be obtained. The breakdown of this score is as follows: 13 out of 22 for Nature of Science, 45 out of 72 on the Science Content Knowledge, and 10 out of 16 on Science, Technology, and Society.

To determine Science Teaching Self-Efficacy level of respondents, Science Teaching Efficacy Belief Instrument (STEBI-B) was used. The instrument is a 5-point scale where 1 represents “Strongly Disagree” while 5 is “Strongly Agree. Both subscales of the instrument, Personal Science Teaching Efficacy Belief (PSTE) and Science Teaching Outcome Expectancy (STOE), were used.

Data collection was done during the second semester of the school year 2017-2018. Prior to accomplishment of instrument, respondents were fully informed of the matters relative to the conduct of the study. Principles of consent, confidentiality, and anonymity were ascertained.

2.4 Data Analysis
The respondents’ scores for scientific literacy and science teaching self-efficacy were obtained through the use of TBSL and STEBI-B respectively. The data were run and analyzed through SPSS program package. The obtained scores for scientific literacy and science teaching self-efficacy were
independently analyzed using descriptive statistics, while the relationship between the respondents’ scientific literacy and science teaching self-efficacy was determined through Pearson Correlation Coefficient.

3. Results

3.1 Scientific Literacy Level

Data analysis revealed that the respondents have a satisfactory Science literacy level when set against the standard. The mean score of 81 is higher than the score of 68 that must be obtained to be considered minimally scientifically literate. The individual scores across scales are shown in Table 1.

| Table 1. Scientific Literacy Levels across the scales of TBSL |
|------------------------|----------------|
| Scale                  | Mean | SD  |
| Nature of Science      | 16.25| 2.112|
| Science Technology and Society | 12.05| 3.204|
| Science Content Knowledge | 52.7 | 8.920|
| Total                  | 81   |     |

It is worth noting from Table 1 that across scales, the respondents performed better than the minimum score set per scale. For nature of science mean score of 16.25 was recorded, when the minimum score for the “minimally scientifically literate” level to be achieved is 13. Also, a higher score for Science Technology and Society was noted to be at 12.05, when the minimum score to be achieved is 10. The respondents’ mean score for Science Content Knowledge at 52.7 was higher than the minimum acceptable score of 45.

3.2 Science Teaching Self-Efficacy Level

3.2.1 General Science Teaching Self-Efficacy Level

Results of the analysis of the respondent general Science Teaching Self-Efficacy Level is reported in Table 2. The highest possible score that an individual can get in STEBI-B is 118 while the lowest possible score is 23. The general mean of the respondents’ STEBI-B scores was 86. When individual scores were examined per item, it equals 3.9 (≈4.00; agree). The results show a medium level of self-efficacy in science teaching. The result specific to the sub-scales of STEBI-B is

| Table 2. Descriptive Statistics of the respondents’ general scores on STEBI-B |
|------------------------|--------|--------|--------|--------|--------|--------|
| N                      | Mean   | Sd     | Min.   | Max.   | Md     | Mo     |
| 50                     | 86     | 9.81   | 48     | 99     | 89     | 90     |

3.2.2 Sub-scale specific result of STEBI-B

It can be gleaned from Table 3 that the respondents’ PSTE and STOE means are 48.6 and 37.4 respectively. When individual scores for both sub-scale were considered very closely, both were ≈4.00 which means that either subscale is at the medium level of interpretation.

| Table 3. descriptive statistics of the respondents’ scores per STEBI-B subscale |
|------------------------|--------|--------|--------|--------|--------|--------|
| Sub-scale | N       | Mean   | Sd     | Min.   | Max.   | Md     |
| PSTE      | 50      | 48.60  | 6.220  | 25     | 61     | 48     | 53     |
| STOE      | 50      | 37.40  | 7.002  | 20     | 45     | 40     | 37     |

3.3 The relationship between scientific literacy and science teaching self-efficacy.
Correlation coefficient between the respondents’ scientific literacy and science teaching self-efficacy was computed using Pearson’s Product-Moment Correlation. Results showed an r value of 0.488 which can be interpreted as moderately strong correlation.

4. Discussions
This study revealed that pre-service secondary science teacher respondents have a satisfactory level of scientific literacy. Their score means score of 81 is way above the minimum accepted score of 68 to be considered scientifically literate. This means that the respondents have the ability to critically and rationally think about science in the context of likely personal, social, political, and economic challenges of everyday living. He argued that a rich previous experience about science will increase the chance of hitting a high scientific literacy mark. Regarding results in the sub-scales of TBSL, there were notably high marks across sub-scales. It also interesting to know that mean scores in Science Content Knowledge was the highest. This can be attributed to a good foundation of science concepts in their early years of study.

On the other hand, in studies exploring scientific literacy of pre-service elementary teachers. Scientific literacy levels were found out to be low to very low. Determining the scientific literacy levels of teachers

Looking at the level of science teaching self-efficacy, pre-service secondary science teacher respondents were at the medium level. This means that they have, on the average, the confidence in their abilities as a science teacher. Those with established self-efficacy have confidence in their experiences to develop methods, approaches, techniques, and strategies to overcome hurdles in teaching. This idea stresses the importance of guaranteeing that teachers must have high self-efficacy if the educational systems' goal is to affect quality education.

Parallel to the results of this study, quite a number of related studies found that pre-service teachers’ self-efficacy scores for science teaching are high.

With respect to the relationship between scientific literacy and science teaching self-efficacy, moderately strong correlation was noted. This means that a high scientific literacy translates to a high science teaching self-efficacy. Conversely, those with low scientific literacy have low science teaching self-efficacy. The higher the ability to think rationally and scientifically about pressing concerns of daily life, the more confident an individual believes he can perform. This finding goes to the key figures in the educational system. Focus must be given to ensure that teachers possess an acceptable level of scientific literacy and teaching self-efficacy.

5. Conclusions
Results of the study showed that pre-service secondary science teacher respondents have satisfactory scientific literacy level and medium level science teaching self-efficacy. This means that the preservice science teachers of the university have developed rational and scientific attack to common daily problems and are confident in their abilities to deliver science instruction. Further, a moderately strong relationship was noted between scientific literacy and science teaching self-efficacy. As scientific literacy increases, the belief in once ability to teach science increases.

This study has implications for teaching and learning as well as the education system itself. Preservice teachers need to be assessed relative to their readiness. It is emphasized that the teacher remains to be one of the key figures in shaping the educational system. Their preparation and readiness speak of the success of reforms set forth.

6. References
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