



# Measuring Undergraduates' Evaluation of Scientific Information and Arguments using Scientific Literacy Skills (SLS)

Celeste T. Mercado

Pangasinan State University

**Abstract** – *There is a consistently poor performance of Filipino students in international assessment (TIMSS and PISA) studies and national assessment studies. Studies reveal that Filipino students have low retention of concepts, have limited reasoning and analytical skills, and poor communication skills. Findings of this study will be used to strengthen emphasis on information literacy in order to rid from fake news or misinformation. The study sought to present the scientific literacy skills profile PSU Lingayen students, what science literacy skills do most PSU students possess or needs improvement. The research was conducted in Pangasinan State University, Lingayen Campus in January – August 2018. The population in this research was third year students of all programs offered in the campus. The sample used was 390 students, 30 students from each program using purposive sampling technique The study is descriptive in nature. The design is to make description systematically, factual, and accurate about scientific literacy skills undergraduate students of PSU Lingayen. The research did not provide treatment, manipulation or alteration to the independent variables, but describes a condition as it is. It utilized the Science Literacy Test was adapted. The study found that most of the students have scored below the median score based on Scientific Literacy Skills (SLS) test conducted. Students from the BS Math have the highest SLS while the students from BS IT have the lowest SLS. On average, College of Education has the highest SLS and College of Technology has the lowest SLS. There is varied performance of students on the different SLS skills. Curricular reform to include activities and provide opportunities targeting the development of SLS, send teachers to training to gain pedagogical skills in delivery science lessons, integrate SLS to other courses, conduct seminar on Information Literacy among teachers and faculty focusing on evaluation of scientific arguments are the recommendations provided in the study.*

**Keywords** – *Scientific Literacy skills*

## INTRODUCTION

To support the government in its effort to develop its citizens who are scientifically literate and are able to use information in science as tool to learn and acquire relevant knowledge and skills to equip them to become productive members, the study deemed it helpful to determine the level of SLS of the undergraduate students of PSU Lingayen Campus across all programs.

## OBJECTIVES OF THE STUDY

The study was conducted to determine the scientific literacy skills of students in Lingayen Campus in all subjects. Specifically, it aims to profile the SLS of students in all of the programs and by College and identify what SLS do most PSU students have most and least acquired or developed. Respondents' performance on the specific (nine) science literacy skills was looked

into to determine which skills have been most acquired and least acquired. Through this study, recommendations can be formulated to enrich the curriculum of subjects which targets the development of those skills which need more improvement and maintain activities that cater to the development of skills which the students have mostly developed.

## MATERIALS AND METHODS

The study is descriptive in nature. The design is to make description systematically, factual, and accurate about scientific literacy skills undergraduate students of PSU Lingayen. The study was conducted in Pangasinan State University, Lingayen Campus, Lingayen Pangasinan from January to August 2018 which covered the second semester. The population in this research was third year students of all programs offered in the campus. Third year students were identified because the students have already taken mostly their science-related courses

in General Education as well as major courses. The sample used was 390 students, 30 students from each program using purposive sampling technique. The questionnaire utilized in the study was adapted from Gormally et al. (2012) called Science Literacy Test which was content validated by international experts..

### RESULTS AND DISCUSSION

The succeeding figures show the Ranked Scientific Literacy Test Scores per program, Scientific Literacy Test Scores by College and the Scores of the respondents on the different Scientific Literacy Skills

#### Scientific Literacy Skills Per Program

There are a total of fourteen (14) academic programs offered in PSU Lingayen Campus. The figure on the next page presents the Ranked Scientific Literacy Test Scores per program. It can be seen that respondents from Bachelor of Science in Mathematics, Bachelor of Science in Nutrition and Dietetics and Bachelor in Secondary Education ranked highest in the test, while the programs, Bachelor of Science in Industrial technology, Bachelor of Science in Social Work and Bachelor of Science in Business Administration scored lowest. This result may be explained by the fact that these course with highest SLS are more science oriented, meaning the students are more exposed to science subjects than those courses within the lowest score.

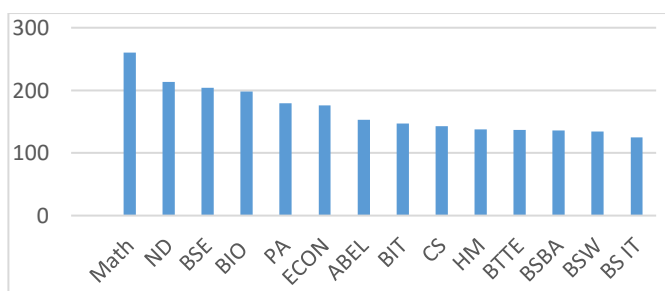


Figure 1. Ranked Scientific Literacy Test Scores per program

#### Scientific Literacy Skills by College

PSU Lingayen Campus is grouped into five colleges namely College of Education, College of Hospitality, Business and Public Administration, College of Arts, Sciences and Letters, College of Technology and College of Computing Science. Based from the scores obtained by the respondents drawn from each program under these colleges, the figure below present the SLS by College.

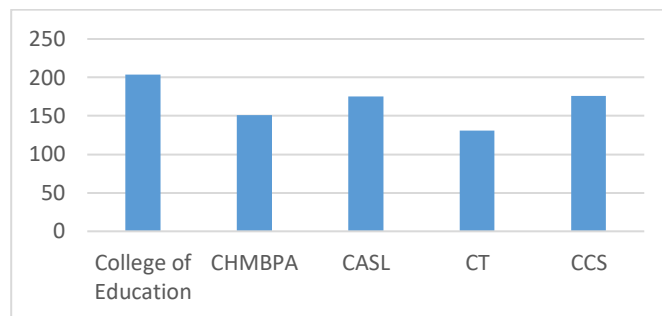


Figure 2. Scientific Literacy Test Scores by College

Based on the figure, the respondents from College of Education has the highest SLS while those from the College of Technology with the lowest SLS. This may be explained by the reason that students who are admitted to College of Education, which is a Board Program requires at least with a general weighted average (GWA) of 85 and those in the Technology program are more trained to become skilled like automotive, industrial technology and electronics technology and do not demand admission requirement as of College of Education, meaning students with GWA lower than 85 may be admitted.

#### Scores on the different Scientific Literacy Skills

Gormally (2012) used the following skills in his SLS Test 1.) Identify a Valid Scientific Argument 2.) Evaluate the Validity of Sources 3.) Evaluate The Use and Misuse Of Scientific Information 4.) Understand Elements of Research Design and How They Impact Scientific Findings/Conclusions 5. ) Create Graphical Representations of Data 6.) Read And Interpret Graphical Representations of Data 7.) Solve Problems Using Quantitative Skills, Including Probability and Statistics 8.) Understand and Interpret Basic Statistics and 9.) Justify Inferences, Predictions, and Conclusions Based on Quantitative Data.

In this study, the respondents' scores on the different skills were looked into to determine which particular SLS they have most acquired as well as least acquired.

#### *Skill Number 1: Identify a Valid Scientific Argument*

This skill recognizes what qualifies as scientific evidence and when scientific evidence supports a hypothesis. Example of common challenges under this is inability to link claims correctly with evidence and lack of scrutiny about evidence. Facts or even unrelated evidence considered to be supportive for scientific

arguments. Inability to identify accuracy and credibility issues.

In the figure below, for Skill Number 1: Identify a Valid Scientific Argument, College of Computing Science obtained the highest score while College of Technology got the lowest.

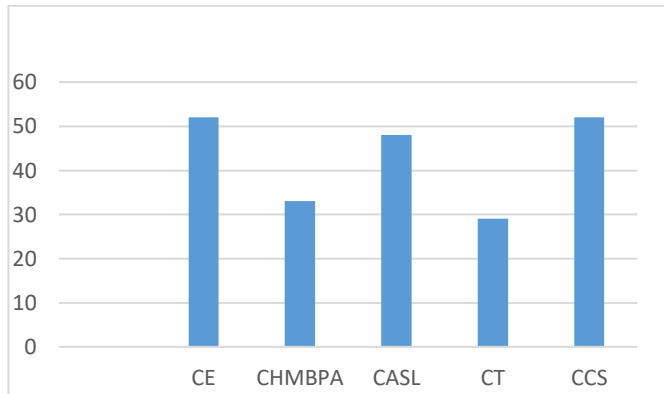


Figure 3. Skill No.1 Identify a Valid Scientific Argument

*Skill Number 2: Evaluate the Validity of Sources*

This skills distinguishes types of sources, identify bias, authority and reliability from them. Some students' challenges and misconceptions include inability to identify accuracy and credibility issues.

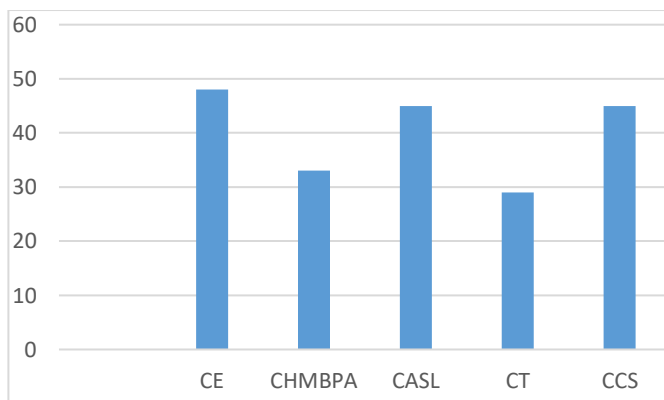


Figure 4. Skill No.2 Evaluate the Validity of Sources

Based from the figure above, the College which obtained highest score in Skill Number 2: Evaluate the Validity of Sources is College of Education while the lowest is, again, the College of Technology.

*Skill Number 3: Evaluate the Use and Misuse of Scientific Information*

The skill recognizes a valid and ethical scientific course of action and identify appropriate use of science

by government, industry and media that is free of bias, economic and political pressure to make societal decisions. One of the challenges students face for this skill is the prevailing political beliefs which can dictate how scientific findings are used.

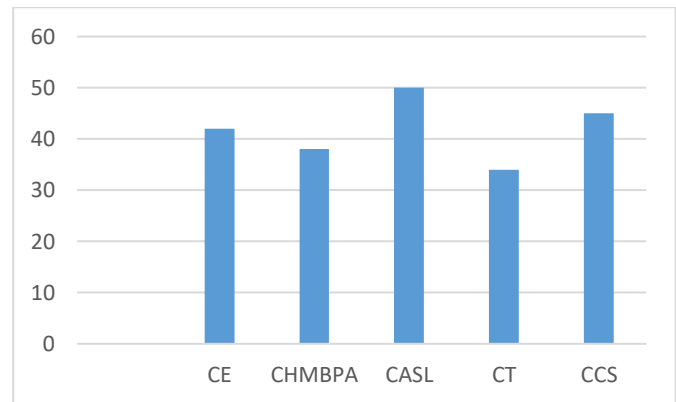


Figure 5. Skill No.3 Evaluate the Use and Misuse of Scientific Information

Based from the above figure, the College of Arts, Sciences and Letters obtained the highest score while the College of Technology got the lowest.

*Skill Number 4: Understand Elements of Research Design and How They Impact Scientific Findings/Conclusions*

One of the indicators of this skills is to identify strengths and weaknesses in research design related to bias, sample size, randomization and experimental control. Students are somehow challenged on their basic understanding of a good research. Based on the figure below, College of Computing Science obtained the highest score while College of Technology, again got the lowest.

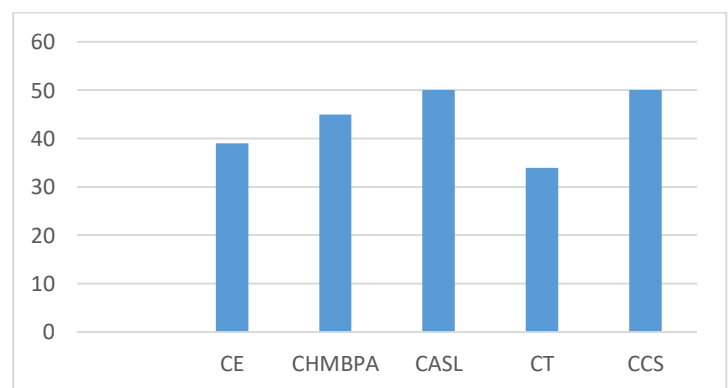


Figure 6. Skill No.4 Understand Elements of Research Design and How They Impact Scientific Findings/Conclusions

*Skill Number 5 Create Graphical Representations of Data*

The skills highlights the identification of the appropriate format for the graphical representation of data given particular type of data. In the figure below the College of Computing Science obtained the highest while the College of Technology obtained the lowest score.

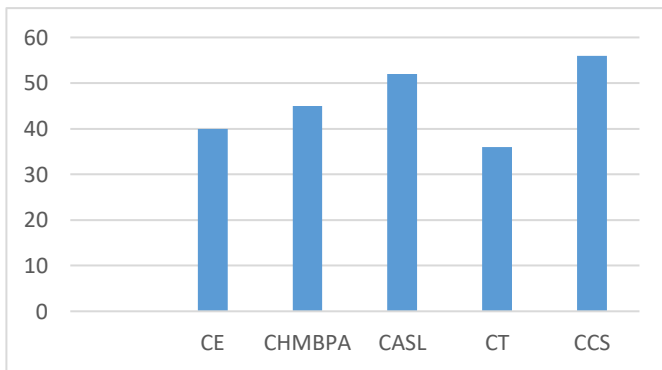


Figure 7. Skill No.5 Create Graphical Representations of Data

*Skill Number 6: Read and Interpret Graphical Representations of Data*

This is the ability to interpret data presented graphically to make a conclusion about a study. One of the challenges of the students is difficulty in interpreting graphs and inability to match patterns of growth with graph shape. In the figure below, College of Computing Science has the highest score while College of Technology has the lowest.

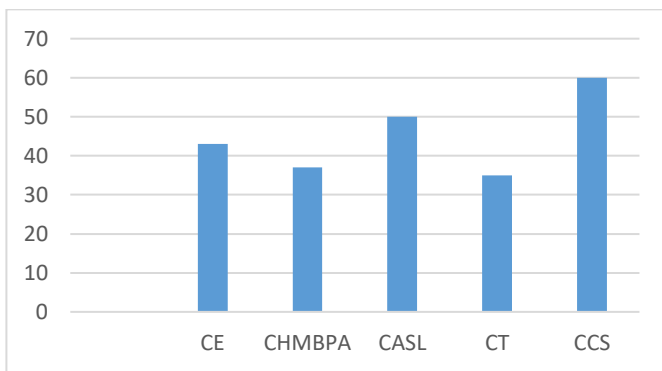


Figure 8. Skill No.6 Read and Interpret Graphical Representations of Data

*Skill Number 7: Solve Problems Using Quantitative Skills, Including Probability and Statistics*

This skills is to calculate probabilities, percentages and frequencies to draw a conclusion. Students are generally challenged to guess the correct answer without being able to explain basic math calculations. According to the figure, College of Computing Science has the highest score while College of Technology, the lowest.

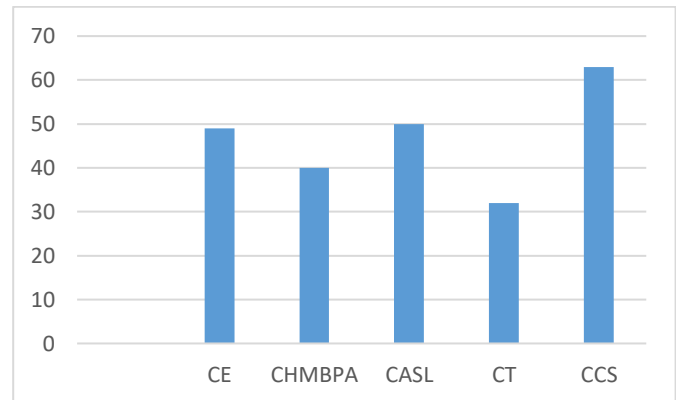


Figure 9. Skill No.7 Solve Problems Using Quantitative Skills, Including Probability and Statistics

*Skill Number 8: Understand and Interpret Basic Statistics*

This skills is needed to understand the need for statistics to quantify uncertainty in data. Most students are having a difficulty in getting familiarized with the functions of statistics and prove if a data is correct. Consistent with the earlier results, College of Computing Science got the highest score while College of Technology, lowest.

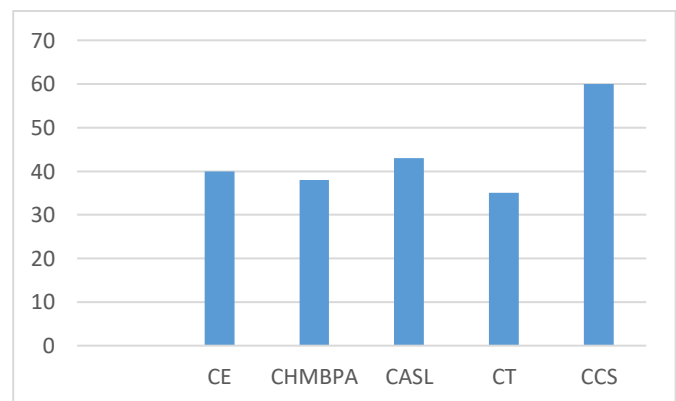


Figure 10. Skill No.8 Understand and Interpret Basic Statistics

*Skill Number 9: Justify Inferences, Predictions, and Conclusions Based on Quantitative Data*

The skill is about interpreting data and critique experimental designs to evaluate hypothesis and recognize flaws in arguments. However, some students tend to misinterpret or ignore graphical data when developing a hypothesis or evaluating an argument. In the figure, College of Computing Science obtained the highest score while College of Technology the lowest score.

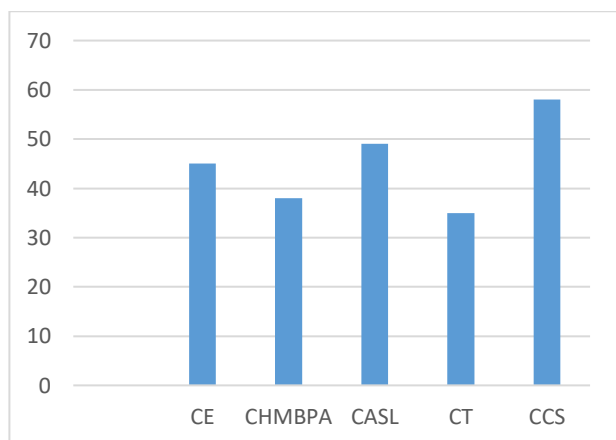


Figure 11. Skill No.9 Justify Inferences, Predictions, and Conclusions Based on Quantitative Data

To sum up, the College of Computing Technology got the highest score in eight out of nine skills in SLS. This is because the respondents are more exposed to curricular activities that target the development of these skills than the rest of the groups. On the other hand, College of Technology was consistent to be the lowest in rank as the program's nature is geared towards the development of skills-based outcomes.

**CONCLUSION AND RECOMMENDATION**

**Conclusion**

Most of the students have scored below the median score based on SLS test conducted. Students from the BS Math have the highest SLS while the students from BS IT have the lowest SLS. On average, College of Education has the highest SLS and College of Technology has the lowest SLS. There is varied performance of students on the different SLS skills.

**Recommendation**

Curricular reform to include activities and provide opportunities targeting the development of SLS. Send teachers to training to gain pedagogical skills in delivery

science lessons. Integrate SLS to other courses not just in science and lastly conduct seminar on Information Literacy among teachers and faculty focusing on evaluation of scientific arguments.

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