



STATISTICAL LITERACY AMONG UNDERGRADUATE STUDENTS IN CHENNAI: A SURVEY STUDY

Statistics

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ABSTRACT

Background: Statistical literacy has been recognized as an essential knowledge for the undergraduate students to possess basic concept of statistical knowledge. **Aim:** The aim of this study was to evaluate the level of statistical literacy among undergraduate students in Chennai. **Materials & Methods:** The two-element model of statistical literacy by Gal (2004), knowledge component (comprised of five cognitive elements: literacy skills, statistical knowledge, mathematical knowledge, context knowledge, and critical questions) and a dispositional component (comprised of two elements: critical stance, and beliefs and attitudes), was used. A survey was conducted on 283 undergraduate students of various colleges of Chennai. **Results:** The results revealed that the undergraduate students had moderate level of overall statistical literacy, knowledge component and a dispositional component. In the knowledge component, the students had high level of literacy skills and mathematical knowledge, moderate level of statistical knowledge and low level of context knowledge. Additionally, in the dispositional component, the students had moderate level of critical stance, and beliefs and attitudes. **Conclusion:** The practical implications for educators to improve students' statistical literacy were discussed.

KEYWORDS

Statistical Literacy; Attitude toward Statistics; Scope of statistics; Statistical Awareness.

Introduction:

Statistical literacy has been documented as an essential knowledge that all citizens need to possess in today's information-driven society. In today's world, data is readily available and easy to obtain. Some of the information may be corrupted. People often assume a statistic presented to them in the news as real, so it can lead to biased decision¹. Being statistically literate enables one to assess the information presented in a right manner leading to correct judgement². Therefore, the need for a statistically literate public is vital. Introductory statistics course is every department of education is generally a way to enhance knowledge of statistics. However, this method did not confirm that student have statistical literacy focused on critically evaluate statistical results. The aim of this study was to assess the level of statistical literacy among undergraduate students in Chennai. This research can provide the foundation for higher studies to optimize factors such as teaching method or course format in order to help students develop the knowledge, strategies, insights to challenge statistical claims, to develop statistical literacy and helping the students with career options in relation to the field of statistics. Results from this study may facilitate development of future courses focused on enhancing the aspect of statistical literacy, the development of instrument to assess components of statistical literacy and the rising career options from the field of statistics.

Materials & Methods

Selection of participants was accomplished by using a simple random sampling method. Participants, 283 undergraduate students, 121 males and 162 females, were students pursuing undergraduate courses in various fields of education, who had studied various courses on statistics in their course. The seven instruments that used to examine statistical literacy in this study encompassed the six elements of Gal's (2004) model of statistical literacy. The elements were separated into two categories (knowledge and dispositional elements). There were four knowledge elements (literacy skills, mathematical knowledge, statistical knowledge, and context knowledge) and two dispositional elements (critical stance, and beliefs and attitudes) shown in Table 1. The first four instruments examined four knowledge elements: literacy skills, mathematical knowledge, statistical knowledge and context knowledge. The first instrument comprised 5 questions from the literacy skills topic, the second 7 questions from statistical knowledge topic, the third 2 questions from mathematical knowledge, and the fourth 2 questions from context knowledge. Each question was designed to be answered from four choices. One mark was given for each correct answer and zero mark for an incorrect answer. The sixth instrument was designed to examine the first of two dispositional elements of statistical literacy and critical stance by using the Scale of Critical Stance³. This instrument contained 6 statements to measure individuals' perception of how they responded to statistical messages

in the media. The scale consisted of 6 statements and used a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) shown in [Figure 1]. A higher score on the SCS indicated a higher level of critical stance in student. Finally, the seventh instrument examined the second of two dispositional elements of statistical literacy: belief and attitudes, and was accomplished by using the Survey of Attitudes Toward Statistics^{4,5}, in combination with an extension of students' open-ended responses. Responses on the SATS (28-item) were measured on a 5-point Likert scale, with 1 meaning strongly disagree, 3 neither disagree nor agree, and 5 strongly agree. A higher score on the SATS indicated a more positive attitude toward statistics^{7,8}. The overall total scores from seven instruments were used to measure the students' statistical literacy. A higher score on overall total scores indicates a higher level of statistical literacy in student. One sample t-test is used when the dependent variable is nominal and there is more than one independent variable. All statistical analysis was performed using SPSS Package.

Table 1. The survey instrument in study

Indicators	Definitions	Measures
Knowledge elements:		
Literacy skills	Ability to understand the reading of various non-prose texts, for example, graphs, tables or symbols.	Adapted from Gal (2004)
Statistical knowledge	Ability to understand why data are needed and how data can be produced, familiarity with basic terms and ideas related to descriptive statistics, graphical and tabular display, understanding the basic notions of probability, and understand how statistical conclusions or inferences are reached.	Adapted from Gal (2004) and Wade (2009)
Mathematical knowledge	Ability to understand the sum of a large number of observations by a concise quantitative statement (e.g., percent and mean).	Adapted from Gal (2004) and Wade (2009)
Context knowledge	Ability to place the statistical messages in context.	Adapted from Gal (2004) and Wade (2009)
Dispositional elements:		
Critical Stance	Individuals' perception of how they respond to statistical messages in the media.	CSC by Wade (2009)

Belief and Attitude	Individuals' attitudes toward statistics shape their behaviour toward statistics (e.g., studying habits, importance of, etc.), which affect their belief systems.	STATS by Schau, et al. (1995).
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- University.
8. Wallman, K. K. (1993). Enhancing statistical literacy: Enriching our society. *Journal of the American Statistical Association*, 88(421), 1-8.

Results & Discussion:

The statistical analysis of this study involved descriptive statistics, mean and standard deviation. [Table 2] shows undergraduate students having moderate level of overall statistical literacy, knowledge component and a dispositional component. In the knowledge component, the students had high level of literacy skills and mathematical knowledge, moderate level of statistical knowledge and low level of context knowledge. Additionally, in the dispositional component, the students had moderate level of critical stance, and beliefs and attitudes. In addition, female and male students had similar levels of statistical literacy. The non-significant differences in overall and sub-components of statistical literacy between female and male students were evident with p-value more than 5% significance levels. To further improve on statistical literacy, the subject has to include in the syllabus of the undergraduate students on a broader level.

Table 2. Mean and standard deviations of Statistical literacy

Statistical Literacy	Overall			Gender				P Value
	Mea n	S. D	Level	Male Mean	S. D	Female Mean	S. D	
Knowledge Component	32.99	15.51	Moderate	31.74	15.37	33.913	15.23	> 0.05
Literacy	8.63	4.18	High	8.62	4.17	8.64	4.12	> 0.05
Statistics Knowledge	14.32	7.08	Moderate	13.21	6.72	15.14	7.07	< 0.05
Mathematical knowledge	4.14	1.91	High	4.16	1.92	4.12	1.90	> 0.05
Context Knowledge	5.90	2.34	Moderate	5.75	2.56	6.01	2.14	> 0.05
Disposition component	11.78	4.49	Moderate	11.85	4.49	11.72	4.35	> 0.05
Critical Stance	3.57	1.28	Moderate	3.60	1.19	3.55	1.32	> 0.05
Belief & Attitude	8.21	3.21	Moderate	8.25	3.30	8.17	3.03	< 0.05
Overall	44.77	18.72	Moderate	43.59	19.86	45.638	19.58	> 0.05

Conclusion:

The findings suggested that for teachers who are currently teaching statistics topics, they are expected to pay more focus on statistical and contextual knowledge and should be encouraged to diversify their teaching methods to allow students to practice their statistics literacy through hands-on practical work and exercises.

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REFERENCES:

- Dani, B. Z., & Joan, G. (2004). Statistical literacy, reasoning, and thinking: Goals, definitions, and challenges. In *The challenge of developing statistical literacy, reasoning and thinking* (pp. 3-15). Springer, Dordrecht.
- Ben-Zvi, D., & Garfield, J. B. (Eds.). (2004). *The challenge of developing statistical literacy, reasoning and thinking* (pp. 3-16). Dordrecht, The Netherlands: Kluwer academic publishers.
- Garfield, J., & Ben-Zvi, D. (2004). Research on statistical literacy, reasoning, and thinking: Issues, challenges, and implications. In *The challenge of developing statistical literacy, reasoning and thinking* (pp. 397-409). Springer, Dordrecht.
- Rumsey, D. J. (2002). Statistical literacy as a goal for introductory statistics courses. *Journal of statistics education*, 10(3).
- Schau, C., Stevens, J., Dauphinee, T. L., & Vecchio, A. D. (1995). The development and validation of the survey of attitudes toward statistics. *Educational and psychological measurement*, 55(5), 868-875.
- Schild, M. (1999). Statistical literacy: Thinking critically about statistics. *Of Significance*, 1(1), 15-20.
- Wade, B. A. (2009). Statistical literacy in adult college students. *The Pennsylvania State*