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Undergraduate Students' Attitude towards the Statistics Course

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***Abstract*—**The purpose of this study was to address and comparison of the attitudes towards the statistics course for undergraduate students. Data were collected from 120 students in Faculty of Sciences and Technology, Suan Sunandha Rajabhat University who enrolled in the statistics course. The quantitative approach was used to investigate the assessment and comparison of attitudes towards statistics course. It was revealed that the overall attitudes somewhat agree both in pre-test and post-test. In addition, the comparison of students' attitudes towards the statistic course (Form A) has no difference in the overall attitudes. However, there is statistical significance in all dimensions and overall attitudes towards the statistics course (Form B).

***Keywords*—**Statistics attitude, Student's attitude, Statistics, Attitude test.

I. Introduction

STATISTICAL education has become a more important concern in the information age. Much of the information in the world around us is determined mathematically by using statistics. Application of statistics is very wide in almost every field such as Business, Industry, Economics, Physics, Chemistry, etc. Correct statistical usage provides not only any trends in what has happened in the past, but also predicts what may happen in the future. Therefore, statistics courses are important and compulsory at the higher education level both for undergraduate and graduate students. Moreover, statistics continues to equip students with the technical and logical skills in problem solving. As Giesbrecht [1] pointed out, almost every discipline, the ability to understand, interpret, and critically evaluate research findings are becoming an essential core skill. In addition, Buche and Glover [2] agreed that college students interested in becoming practitioners need to be able to comprehend, appreciate, and apply research.

Most statistics teachers are generally focused on improving the cognitive aspects of instruction with little interest in the emotional component of learning [3]. Nowadays, attitudes towards statistics have increasingly more consideration in statistics education. Pajares [4], Bandura [5], and Gal, Ginsburg & Schau [6] showed that attitude towards statistics influences a person's statistical behavior inside and outside classroom and their willingness to attend statistics courses in the future. Furthermore, In addition, Schau [7] pointed out that positive attitudes towards statistics would help students to understand that statistics is useful for their professional and personal lives, and students can be trained to understand and use statistics. The importance of roles to accomplish the statistics achievement is both cognitive skills and students' attitudes. The purpose of this study was to investigate the attitudes towards statistics course for undergraduate students and comparison of attitudes between pre-test and post-test.

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II. Materials and Methods

A. Attitude Assessment Instruments

The attitudinal tools were developed by many statistics researchers and educators. Roberts and Bilderback [8] created the Statistics Attitude Survey (SAS) consisting of 33 items in 4 aspects: - value, cognitive competence, affect, and difficulty on a 5-point Likert scale, ranging from Strongly Agree through Neutral to Strongly Disagree to predict a students' achievement in statistics class. Wise [8] built Attitudes Towards Statistics (ATS) by improving on the limitations of the SAS. The ATS focuses on measuring the changes in students' attitudes from the beginning to the conclusion of a statistics course. It is comprised of a 29-item in Field component named Value and Course component called Affect. In addition, Sutarso [9] established a 24-item instrument, Students' Attitude Toward Statistics (STATS) but a small-scale pilot study indicated that this instrument particularly differed from the SAS and ATS. The Inventory for Statistics (CSIS) has been designed by Jarrell and Burry [10], but its items evaluate general test-taking skills and coping strategies. Schau et al. [10] developed the Survey of Attitudes Toward Statistics (SATS). The SATS is a 7-Likert scale instrument (Strongly Disagree to Strongly Agree) that consists of 36 items in 6 subscales: - Affect, Cognitive Competence, Difficulty, Value, Interest, and Effort.

B. Materials and Methods

In this study, the attitude assessment instruments were developed by adapting SAS, ATS, and SATS in Attitudes Towards Statistics Form A and Form B. A semantic differential scale in conjunction with a Visual Analogue Scale developed by Osgood et al. [11] was used to perform the tests. The first attitude survey (Form A) was created to determine Attitudes towards Statistics by a quantitative rating of a topic along a continuum defined by bipolar adjective pairs (e.g. Simple-Difficult, Worthless-Valuable, etc.). Each position on the continuum was assigned an associate score value. A factor analysis was performed to evaluate 3 dimensions: Difficulty, Usefulness, and Enjoyableness. The second Attitude survey

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(Form B) had a series of statements (16 items). The students had to respond whether they agreed or disagreed by using a visual analogue scale from -5 to +5. A factor analysis was performed on the responses and four factors emerged: Difficulty, Importance, Creativeness, and Motivation.

The Attitude Surveys were administered by the researcher to 120 participants who studied in the Faculty of Sciences and Technology, Suansunandha Rajabhat University and enrolled in the first statistics course at the first class meeting and at the end of the course to provide post-test data for comparison. Item responses were hand-coded by using a scale from -5 to +5, which the respondent marked. The quantitative approach was used to assess undergraduate students' attitudes towards the statistics course and the comparison between pre-test and post-test of the students' attitudes.

III. Results

In assessing the descriptive statistics of undergraduate students' attitudes towards statistics course, it was revealed that the students' attitudes towards statistics agreed somewhat in overall attitudes towards statistics in Form A both in the pre-test and post-test. Moreover, the students also assessed the attitudes towards statistics in the same way in each dimension and item, except in the Useful Dimension. The results are shown in Tables I –II.

TABLE I
MEAN AND STANDARD DEVIATION SCORE (PRETEST) OF ATTITUDE TOWARDS STATISTICS COURSE FORM A (BIPOLAR ADJECTIVE PAIRS)

Dimension/Adjective pairs	$\overline{X}$	S.D.	Assessment
I. Difficult	**1.98**	**1.79**	**Somewhat agree**
1.1 Simple - Difficult	1.88	2.48	Somewhat agree
1.2 Easy to understand - Complicated	1.58	2.42	Somewhat agree
1.3 Easy - Hard	2.09	2.25	Somewhat agree
II. Useful	**3.71**	**1.80**	**Strongly agree**
2.1 Not important - Important	3.62	3.40	Strongly agree
2.2 Worthless - Valuable	3.51	1.68	Agree
2.3 Not useful - Useful	3.78	1.60	Strongly agree
III. Enjoyable	**-0.48**	**2.07**	**Neither agree or disagree**
3.1 Not enjoyable - Enjoyable	-0.03	2.69	Neither agree or disagree
3.2 Not exciting - Exciting	-0.11	2.79	Neither agree or disagree
3.3 Not boring - Boring	-0.64	2.81	Neither agree or disagree
Total	**1.74**	**0.99**	**Somewhat agree**

From Table I, the students' attitudes towards the statistics course for pre-test strongly agreed in statistics course's Useful dimension, neither agreed or disagreed in the Enjoyable dimension, and their attitudes pointed that the overall attitude was somewhat agreed.

From Table II, the post-test students' attitudes towards statistics course changed to agree that the statistics course is useful, but in many items and dimensions, the students assessed the same ideas.

The comparison of the pre-test and post-test in undergraduate attitudes towards statistics in Form A showed that there is statistic significance in all dimensions. However, there is no difference in the overall attitudes.

TABLE II
MEAN AND STANDARD DEVIATION SCORE (POSTTEST) OF ATTITUDE TOWARDS STATISTICS COURSE FORM A (BIPOLAR ADJECTIVE PAIRS)

Dimension/Adjective pairs	$\overline{X}$	S.D.	Assessment
I. Difficult	**1.43**	**1.83**	**Somewhat agree**
1.1 Simple - Difficult	1.54	2.25	Somewhat agree
1.2 Easy to understand - Complicated	1.08	2.33	Somewhat agree
1.3 Easy - Hard	1.67	1.92	Somewhat agree
II. Useful	**3.08**	**1.61**	**Agree**
2.1 Not important - Important	3.12	1.71	Agree
2.2 Worthless - Valuable	2.81	1.79	Agree
2.3 Not useful - Useful	3.30	1.75	Agree
III. Enjoyable	**0.25**	**2.01**	**Neither agree or disagree**
3.1 Not enjoyable - Enjoyable	0.69	2.46	Neither agree or disagree
3.2 Not exciting - Exciting	0.47	2.52	Neither agree or disagree
3.3 Not boring - Boring	-0.43	2.54	Neither agree or disagree
Total	**1.58**	**0.98**	**Somewhat agree**

TABLE III
COMPARISON ON ATTITUDE TOWARDS STATISTICS COURSE FORM A

Dimension/Adjective pairs	t	p-value
I. Difficult	2.26	**.025**
1.1 Simple - Difficult	1.31	.193
1.2 Easy to understand - Complicated	1.70	.091
1.3 Easy - Hard	-2.71	.008
II. Useful	**2.88**	**.005**
2.1 Not important - Important	-2.60	.011
2.2 Worthless - Valuable	3.35	.001
2.3 Not useful - Useful	-2.12	.036
III. Enjoyable	**-2.70**	**.008**
3.1 Not enjoyable - Enjoyable	1.95	.054
3.2 Not exciting - Exciting	2.64	.009
3.3 Not boring - Boring	-1.71	.091
Total	**1.27**	**.208**

TABLE VI
COMPARISON ON ATTITUDE TOWARDS STATISTICS COURSE FORM B

Dimension	$\overline{X}$	S.D.	t	p-value
1. Difficulty	**0.97**	**2.97**	**3.59**	**.000**
• Pre-test	0.68	1.89		
• Post-test	-0.29	1.93		
2. Important	**3.09**	**4.35**	**7.79**	**.000**
• Pre-test	2.64	2.34		
• Post-test	-0.46	3.51		
3. Creative	**2.59**	**3.67**	**7.73**	**.000**
• Pre-test	2.30	2.02		
• Post-test	-0.29	3.08		
4. Motivating	**1.06**	**4.44**	**2.62**	**.010**
• Pre-test	1.27	3.08		
• Post-test	0.21	3.15		
Total	**1.31**	**2.91**	**4.94**	**.000**
• Pre-test	**1.04**	**1.68**		
• Post-test	**-0.27**	**2.06**		

For the Attitudes' comparison Form B, it was found that both overall and all dimensions are statistically significant at level .05.

IV. Conclusion

This study was intended to assess the undergraduate students' attitudes towards the statistics course. It would be beneficial for statistics teachers to concern themselves to build strong synergies between cognitive and non-cognitive skills in teaching statistics courses. For the further investigation, several more aspects in attitudes towards statistics course should be added and spread to all students in universities.

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