CHAPTER 4

RESULTS AND INTERPRETATIONS

4.0   Introduction

The students' responses to the three instruments administered in this study were coded prior to data analysis. The data were then processed and analysed using the SPSS programme (Statistical Package for the Social Sciences) for Windows Version 6.00. The analysis of data involved the following descriptive and inferential statistical techniques :

i.   Item-total correlations of the SAI-A dimensions and the ATSSA.

ii.   Cronbach alpha reliability coefficients of the SAI-A dimensions and of the ATSSA.

iii.   *KR-21* of the SAT.

iv.   Descriptive statistics of the SAI-A dimensions in terms of the means, standard deviations, medians, minimums and maximums of science anxiety scores.

v.   Rank order of the top ten anxiety-contributing activities for Form Two students.

vi.   Descriptive statistics of the SAT in terms of the mean, standard deviation, median, minimum and maximum of science achievement scores.

   vii.   *t*-test comparisons between the high and low anxiety groups on their

science achievement scores.

   viii.   Descriptive statistics of the ATSSA in terms of the mean, standard

deviation, median, minimum and maximum of scores for attitude

towards science.

   ix.   *t*-test comparisons between the high and low anxiety groups on their

ATSSA scores.

   x.   *t*-test comparisons between the male and female students on their

science anxiety scores.

4.1   Item-total Correlations

The following sections discuss the item-total correlations of the SAI-A

dimensions and the ATSSA .

4.1.1 Item-total Correlations of SAI-A Dimensions

In the present study, item-total correlation coefficient was computed for

each item in the six SAI-A dimensions to determine whether the items were

contributing significantly to their respective dimension. In performing the item-

total correlations, the score of each item was correlated with the total score of all

the items in its dimension. A minimum correlational value of .3 was used to

include an item in a particular dimension (Kempa, 1986; Swezey, 1982). As shown

in Table 4.1, the item-total correlation coefficients computed for the SAI-A were

all significant and considerably high, ranging from .46 to .83 at $p < .001$. This indicates that all the 39 SAI-A items were significantly contributing to their respective dimensions. It also implies that all the items were duly classified into the six SAI-A dimensions. Therefore, they would be included for subsequent data analyses.

4.1.2 Item-total Correlations of the ATSSA

Item-total correlation coefficients were also computed for the items in the ATSSA to establish whether they were significantly contributing to the scale. Table 4.2 presents the item-total correlation coefficients ranging from .41 to .73 which were significant at $p < .001$. The values are all greater than .30 and hence all the 14 items in the ATSSA would be used for further data analyses.

Table 4.1

Item-total Correlations of SAI-A Dimensions

Item			Item-total Correlation (N = 148)
Dimension :	**Danger Anxiety**		
Item 1	:	Using hazardous chemicals, like acids in the laboratory.	.73**
Item 8	:	Lighting a bunsen burner.	.67**
Item 11	:	Working with chemicals that are poisonous.	.78**
Item 15	:	Using flammable chemicals.	.81**
Item 17	:	Working with an electrical power supply.	.72**
Item 18	:	Heating something with a bunsen burner.	.80**
Item 20	:	Using expensive glass apparatus in the laboratory.	.72**
Item 24	:	Having my teacher explain a laboratory procedure that may be dangerous.	.51**
Dimension :	**Science Test Anxiety**		
Item 4	:	Taking a science test.	.74**
Item 10	:	Studying for a science test.	.70**
Item 23	:	Answering the 'fill-in-the-blank' questions on a science test.	.68**

Table 4.1   (continued)

Item			Item-total Correlation (N = 148)
Item 25	:	Taking the final examination for a science class.	.78**
Item 27	:	Doing the 'multiple-choice' items on a science test.	.76**
Item 29	:	Memorizing science vocabulary words for a test.	.67**
Item 33	:	Solving the answer to a problem on a science quiz.	.71**
Dimension :		**Math and Problem-solving Anxiety**	
Item 2	:	Filling out a data table while doing an experiment.	.47**
Item 6	:	Answering questions regarding a graph in my science book.	.62**
Item 12	:	Identifying an organism using the identification key in a science book.	.46**
Item 19	:	Putting the numbers into a formula to solve a problem involving 'work' and 'power'.	.68**
Item 26	:	Working out word problems on density.	.71**
Item 30	:	Measuring with equipment that has metric units.	.67**

Table 4.1   (continued)

Item			Item-total Correlation (N = 148)
Item 36	:	Changing quantitative units, for example, from square centimetres (cm^2) to square metres (m^2).	.62**
Dimension	**:**	**Squeamish Anxiety**	
Item 5	:	Collecting cheek cells to be observed with a microscope.	.48**
Item 13	:	Using chicken blood to observe the colour of oxygenated and deoxygenated blood.	.79**
Item 16	:	Collecting saliva to examine the effect of its enzyme on food.	.65**
Item 28	:	Collecting cockroaches to use in an experiment.	.79**
Item 31	:	Looking at preserved biological specimen in a bottle.	.67**
Item 35	:	Studying a fresh specimen of a cow's eye in the science class.	.83**
Item 37	:	Observing real teeth of animals.	.65**
Dimension	**:**	**Performance Anxiety**	
Item 9	:	Having my science teacher ask me a question in class.	.66**
Item 14	:	Asking my science teacher a question about something I do not understand.	.61**

(table continues)

Table 4.1   (continued)

Item			Item-total Correlation (N = 148)
Item 14	:	Asking my science teacher a question about something I do not understand.	.61**
Item 21	:	Doing a science project.	.66**
Item 22	:	Explaining the results of a science project to the class.	.72**
Item 34	:	Having my teacher watch me do a laboratory procedure.	.65**
Item 38	:	Explaining the results obtained from an experiment.	.81**
Item 39	:	Answering questions based on the experiment which has just been carried out.	.78**
Dimension :		**Science Classroom Anxiety**	
Item 3	:	Taking notes while my science teacher presents the lessons.	.62**
Item 7	:	Answering questions for science homework.	.75**
Item 32	:	Sitting for a full class period and listening to my teacher teaching a science topic.	.60**

N denotes number of students involved

** denotes one-tailed significant at $p < .001$

Table 4.2

Item-total Correlations of the ATSSA

Items of the ATSSA	Item-total Correlation (N =148)
Item 1 : Science is fun.	.64**
Item 2 : I do not like science and it bothers me to have to study it.	.46**
Item 3 : During science class, I usually am interested.	.65**
Item 4 : I would like to learn more about science.	.64**
Item 5 : If I knew I would never go to science class again, I would feel sad.	.41**
Item 6 : Science is interesting to me and I enjoy it.	.70**
Item 7 : Science makes me feel uncomfortable, restless, irritable and impatient.	.67**
Item 8 : Science is fascinating and fun.	.70**
Item 9 : The feeling that I have toward science is a good feeling.	.70**
Item 10 : When I hear the word science, I have a feeling of dislike.	.69**
Item 11 : Science is a subject which I enjoy studying.	.73**
Item 12 : I feel at ease with science and I like it very much.	.72**
Item 13 : I feel a definite positive reaction to science.	.59**
Item 14 : Science is boring.	.60**

N denotes number of students involved

** denotes one-tailed significant at $p < .001$

4.2   Reliability of the Instruments

The following sub-sections describe the reliability of the instruments used in the study.

4.2.1   Cronbach Alpha Reliability of SAI-A Dimensions

Table 4.3 shows that the estimated Cronbach alpha reliability coefficients of .87 for 'Danger Anxiety', .78 for 'Science Test Anxiety', .71 for 'Math and Problem-solving Anxiety', .82 for 'Squeamish Anxiety', .83 for 'Performance Anxiety', and .35 for 'Science Classroom Anxiety'. 'Danger Anxiety' registers the highest value of alpha reliability whereas 'Science Classroom Anxiety' has the lowest. These values suggest that the internal consistency of each SAI-A dimension was considerably high with the exception for the dimension 'Science Classroom Anxiety'.

Table 4.3

Cronbach Alpha Reliability Coefficients of SAI-A Dimensions

SAI-A Dimensions	Cronbach Alpha Reliability Coefficients
Danger Anxiety	.87
Science Test Anxiety	.78
Math and Problem-solving Anxiety	.71
Squeamish Anxiety	.82
Performance Anxiety	.83
Science Classroom Anxiety	.35

The alpha reliability coefficients computed for the dimensions in this study were quite consistent with those reported in the study of Wynstra (1991) with the exception for 'Science Classroom Anxiety'. Table 4.4 shows the comparisons of the alpha reliability coefficients between Wynstra's (1991) study and the present study. It can be seen from the Table that the alpha reliability coefficients of 'Danger Anxiety', 'Science Test Anxiety' and 'Math and Problem-solving Anxiety' in this study are slightly lower than those of Wynstra. The alpha reliability coefficients obtained for 'Squeamish Anxiety' and 'Performance Anxiety' in this study are slightly higher than the values reported by Wynstra. For 'Science Classroom Anxiety', there is an obvious variation between the alpha coefficient of the two studies where the value obtained in this study is relatively low as compared

to that reported by Wynstra. This might be due to the smaller sample size

(N = 148) involved in the present study as compared to the bigger sample size

(N = 656) of Wynstra's (1991) study. The low value of alpha reliability might also

be due to the small number of items in this dimension of 'Science Classroom

Anxiety'.

In both local studies by Rohana Jantan (1995) and Foo (1996), the test-retest

reliability was established instead of the alpha reliability. Therefore, the alpha

reliability coefficients of the present study could not be compared to those of their

studies.

Table 4.4

Comparisons of the Alpha Reliability Coefficients between Two Studies

SAI-A Dimension	Alpha Reliability Coefficient	
	Wynstra's Study (N = 656)	Present Study (N = 148)
Danger Anxiety	.89	.87
Science Test Anxiety	.88	.78
Math and Problem-solving Anxiety	.84	.78
Squeamish Anxiety	.80	.82
Performance Anxiety	.77	.83
Science Classroom Anxiety	.59	.35

N denotes number of students involved

4.2.2 Cronbach Alpha Reliability of the ATSSA

In the present study, the Cronbach alpha reliability coefficient of the ATTSA was estimated to be .88. This indicates that the instrument could be considered as reliable for assessing the students' attitude towards science in school. Although this is slightly lower than the reliability reported in Germann's (1988) study, it is almost the same as that reported by Lau (1997).

In four studies carried out by Germann (1988) on students from seventh through twelfth grades, the Cronbach alpha reliability coefficients estimated for the ATTSA were all greater than .95. Recently, the ATSSA was adopted by Lau (1997) in her study on Form Two students in Selangor. A Cronbach alpha reliability coefficient of .87 was reported by her.

4.2.3 *KR-21* of the SAT

For the present study, the *KR-21* formula was used to determine the internal consistency of the SAT. The coefficient was estimated to be .67, indicating that the SAT could be considered as a moderately reliable measure of Form Two students' science achievement.

4.3 Descriptive Statistics of Science Anxiety Scores

Table 4.5 presents the means, standard deviations, medians, minimums and maximums of science anxiety scores on the SAI-A and its six dimensions. The overall science anxiety scores of all the items range from 44.00 to 139.00 with a

Table 4.5

Means, Standard Deviations, Medians, Maximums and Minimums of Science Anxiety Scores on SAI-A and Its Dimensions

	SAI-A Dimension						
	Danger Anxiety	Science Test Anxiety	Math and Problem-Solving Anxiety	Squeamish Anxiety	Performance Anxiety	Science Classroom Anxiety	Overall Science Anxiety
Mean	21.78	16.25	11.57	14.92	13.57	3.77	81.86
Standard Deviation	7.05	4.95	3.78	5.93	4.95	1.16	21.99
Median	22.00	15.50	10.50	14.00	12.50	3.00	80.00
Minimum	8.00	7.00	7.00	7.00	7.00	3.00	44.00
Maximum	38.00	32.00	24.00	34.00	31.00	9.00	139.00

median of 80.00. The mean score for the overall science anxiety is 81.86 with a standard deviation of 21.99.

For the dimension 'Danger Anxiety' which consists of eight items, the mean score is 21.78 with a standard deviation of 7.05. The minimum and maximum scores are 8.00 and 38.00 respectively. The median is 22.00.

For the dimensions 'Science Test Anxiety', 'Math and Problem-solving Anxiety', 'Squeamish Anxiety', and 'Performance Anxiety' which comprise seven items respectively, 'Science Test Anxiety' registers the highest mean score (16.25) with a standard deviation of 4.95. The scores on this dimension has a median of 15.50, a minimum of 7.00, and a maximum of 32.00. For the dimension 'Math and Problem-solving Anxiety', the scores range from 7.00 to 24.00, with a median of 10.5. The mean score is 11.57 with a standard deviation of 3.78. The dimension 'Squeamish Anxiety' gives a mean score of 14.92 with a standard deviation of 5.93. The median is 14.00. The minimum and maximum scores are 7.00 and 34.00 respectively. As for the dimension 'Performance Anxiety', the mean score is 13.57 with a standard deviation of 4.95. The scores range from 7.00 to 31.00, with a median of 12.50.

There are three items in the dimension 'Science Classroom Anxiety'. This dimension gives a mean score of 3.77 with a standard deviation of 1.16. The median is 3.00 and the minimum score is also 3.00. The maximum score is 9.00.

To address the Research Question 1 as shown in page 11, the responses of the Form Two students to each item of the SAI-A dimensions are discussed in the

following sub-sections. This would provide a clear picture of how nervous or anxious the students felt towards the science-related activities.

4.3.1 Danger Anxiety

In Table 4.6 (page 81), it can be seen that the item mean scores for the dimension 'Danger Anxiety' range from 2.16 to 3.39, giving an overall item mean score of 2.72 and a standard deviation of .88. Item 11 'Working with chemicals that are poisonous' has the highest mean score (3.39), followed by Item 15 'Using flammable chemicals'. The lowest mean score (2.16) was recorded by Item 24 'Having my teacher explain a laboratory procedure that may be dangerous'

The overall item mean score is 2.72, which is very close to 'Moderately Nervous'. This indicates that the students had moderate anxiety over the danger aspects in science. They might be concerned for their safety in the laboratory especially when they were to conduct experiments involving poisonous or flammable chemicals. They seemed to be worried about the potential dangers of chemicals they were dealing with. When involving themselves with expensive glass apparatus, hazardous chemicals, electrical power supply and bunsen burner, they felt slightly nervous. Although they also felt slightly nervous when listening to a laboratory procedure that might be dangerous, they had the least anxiety on this activity as compared to the above mentioned activities.

Table 4.6

Distribution of Frequency and Percentage of Item Responses and Its Mean and Standard Deviation for the SAI-A Dimension 'Danger Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
1	20 (13.5%)	53 (35.8%)	29 (19.6%)	29 (19.6%)	17 (11.5%)	2.80	1.23
8	43 (29.1%)	58 (39.2%)	23 (15.5%)	19 (12.8%)	5 (3.4%)	2.22	1.11
11	14 (9.5%)	29 (19.6%)	27 (18.2%)	41 (27.7%)	37 (25.0%)	3.39	1.31
15	9 (6.1%)	44 (29.7%)	23 (15.5%)	41 (27.7%)	31 (20.9%)	3.28	1.26
17	38 (25.7%)	47 (31.8%)	20 (13.5%)	26 (17.6%)	17 (11.5%)	2.57	1.35
18	38 (25.7%)	50 (33.8%)	26 (17.6%)	26 (17.6%)	8 (5.4%)	2.43	1.20
20	14 (9.5%)	51 (34.5%)	26 (17.6%)	46 (31.1%)	11 (7.4%)	2.93	1.16
24	52 (35.1%)	50 (33.8%)	21 (14.2%)	20 (13.5%)	5 (3.4%)	2.16	1.15
Overall						2.72	.88

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

Table 4.7

Distribution of Frequency and Percentage of Item Responses and Its Mean and

Standard Deviation for the SAI-A Dimension 'Science Test Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
4	11 (7.4%)	63 (42.6%)	41 (27.7%)	27 (18.2%)	6 (4.1%)	2.69	.99
10	38 (25.7%)	49 (33.1%)	27 (18.2%)	25 (16.9%)	9 (6.1%)	2.45	1.21
23	42 (28.4%)	67 (45.3%)	23 (15.5%)	14 (9.5%)	2 (1.4%)	2.10	.97
25	15 (10.1%)	45 (30.4%)	29 (19.6%)	36 (24.3%)	23 (15.5%)	3.05	1.26
27	38 (25.7%)	47 (31.8%)	20 (13.5%)	26 (17.6%)	17 (11.5%)	1.89	.99
29	66 (44.6%)	47 (31.8%)	15 (10.1%)	16 (10.8%)	4 (2.7%)	1.95	1.11
33	40 (27.0%)	68 (45.9%)	24 (16.2%)	14 (9.5%)	2 (1.4%)	2.12	.96
Overall						2.32	.71

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately

Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

Table 4.8

Distribution of Frequency and Percentage of Item Responses and Its Mean and Standard Deviation for the SAI-A Dimension 'Math and Problem-solving Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
2	116 (78.4%)	22 (14.9%)	6 (4.1%)	3 (2.0%)	1 (0.7%)	1.32	1.32
6	86 (58.1%)	41 (27.7%)	19 (12.8%)	2 (1.4%)	0 (0.0%)	1.57	.77
12	104 (70.3%)	32 (21.6%)	6 (4.1%)	6 (4.1%)	0 (0.0%)	1.42	.76
19	85 (57.4%)	34 (23.0%)	21 (14.2%)	7 (4.7%)	1 (0.7%)	1.68	.93
26	56 (37.8%)	52 (35.1%)	23 (15.5%)	15 (10.1%)	2 (1.4%)	2.02	1.03
30	75 (50.7%)	38 (25.7%)	23 (15.5%)	9 (6.1%)	3 (2.0%)	1.83	1.03
36	77 (52.0%)	44 (29.7%)	19 (12.8%)	7 (4.7%)	1 (0.7%)	1.72	.91
	Overall					1.65	.54

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

Table 4.9

Distribution of Frequency and Percentage of Item Responses and Its Mean and

Standard Deviation for the SAI-A Dimension 'Squeamish Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
5	44 (29.7%)	39 (26.4%)	34 (23.0%)	26 (17.6%)	5 (3.4%)	2.39	1.18
13	58 (39.2%)	39 (26.4%)	23 (15.5%)	15 (10.1%)	13 (8.8%)	2.23	1.30
16	84 (56.8%)	33 (22.3%)	15 (10.1%)	12 (8.1%)	4 (2.7%)	1.78	1.09
28	54 (36.5%)	30 (20.3%)	29 (19.6%)	20 (13.5%)	15 (10.1%)	2.41	1.36
31	64 (43.2%)	45 (30.4%)	18 (12.2%)	16 (10.8%)	5 (3.4%)	2.01	1.14
35	49 (33.1%)	41 (27.7%)	21 (14.2%)	20 (13.5%)	17 (11.5%)	2.43	1.37
37	86 (58.1%)	36 (24.3%)	14 (9.5%)	10 (6.8%)	2 (1.4%)	1.69	.99
			Overall			2.13	.85

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately

Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

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Table 4.10

Distribution of Frequency and Percentage of Item Responses and Its Mean and Standard Deviation for the SAI-A Dimension 'Performance Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
9	26 (17.6%)	65 (43.9%)	31 (20.9%)	23 (15.5%)	3 (2.0%)	2.41	1.02
14	96 (64.9%)	34 (23.0%)	11 (7.4%)	4 (2.7%)	3 (2.0%)	1.54	.90
21	80 (54.1%)	43 (29.1%)	14 (9.5%)	11 (7.4%)	0 (0.0%)	1.70	.92
22	85 (57.4%)	34 (23.0%)	21 (14.2%)	7 (4.7%)	1 (0.7%)	2.05	1.07
34	60 (40.5%)	56 (37.8%)	19 (12.8%)	11 (7.4%)	2 (1.4%)	1.91	.98
38	58 (39.2%)	54 (36.5%)	17 (11.5%)	15 (10.1%)	4 (2.7%)	2.01	1.08
39	60 (40.5%)	57 (38.5%)	15 (10.1%)	10 (6.8%)	6 (4.1%)	1.95	1.07
			Overall			1.94	.71

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

Table 4.11

Distribution of Frequency and Percentage of Item Responses and Its Mean and

Standard Deviation for the SAI-A Dimension 'Science Classroom Anxiety'

Item Number	Frequency (Percentage)					Mean	S.D.
	1*	2*	3*	4*	5*		
3	130 (87.8%)	11 (7.4%)	6 (4.1%)	1 (0.7%)	0 (0.0%)	1.18	.52
7	104 (70.3%)	32 (21.6%)	8 (5.4%)	4 (2.7%)	0 (0.0%)	1.41	.72
32	126 (85.1%)	17 (11.5%)	4 (2.7%)	1 (0.7%)	0 (0.0%)	1.19	.50
			Overall			1.26	.39

Note : 1* = Not At All Nervous, 2* = Slightly Nervous, 3* = Moderately

Nervous, 4* = Nervous, and 5* = Very Nervous

S.D. denotes standard deviation

4.3.2 Science Test Anxiety

As shown in Table 4.7 (page 82), the item mean scores for the dimension 'Science Test Anxiety' range from 1.89 to 3.05. The overall item mean score is 2.32 with a standard deviation of .71. Item 25 'Taking the final examination for a science class' registers the highest mean score of 3.05. Item 4 'Taking a science test' registers the second highest mean score of 2.69. Item 27 'Doing the multiple-choice items on a science test' has the lowest mean score of 1.89. This implies that generally the students manifested moderate test anxiety when sitting for the final examination in science. However, they had less anxiety for the science test than the final examination. They felt slightly nervous when studying and memorizing science vocabulary words for a science test. When answering questions in a science test, they felt more at ease with 'multiple-choice' items than the 'fill-in-the-blank' type of questions.

4.3.3 Math and Problem-solving Anxiety

In Table 4.8 (page 83), the item mean scores for the dimension 'Math and Problem-solving Anxiety' vary from 1.32 to 2.02, giving an overall mean score of 1.65 with a standard deviation of .54. This shows that the students only had slight anxiety towards math and problem-solving in science. The highest mean score was recorded by Item 26 'Working out word problems on density'. 'Density' might be a difficult concept encountered by them in Form One when some of them might not have attained the formal cognitive level. Item 2 'Filling out data table while doing

an experiment' has the lowest mean score (1.32), in which about 78.4% of the students rated their responses as 'Not at all nervous'. This might imply that filling out data was not a problem to most of the students. Usually, prior to the experiment, science teachers had already prepared the table on the board for recording data as well as for use in discussions. Students were very seldom asked to design their own table for recording data. Thus, it was reasonable that these students were not anxious at all for this activity.

4.3.4   Squeamish Anxiety

Table 4.9 (page 84) shows that the overall item mean score and standard deviation for the dimension 'Squeamish Anxiety' are 2.13 and .85 respectively. Item 35 'Studying a fresh specimen of a cow's eye in the science class' registers the highest mean score of 2.43, followed by Item 28 'Collecting cockroaches to use in an experiment' which has a mean score of 2.41. Item 37 'Observing real teeth of animals' has the lowest mean score of 1.69.

The results as shown in Table 4.9 indicate that the students were slightly nervous when dealing with things that might make them squeamish. This was especially true when they were confronted with things like fresh specimen of a cow's eye or live specimens such as cockroaches.

4.3.5 Performance Anxiety

The mean scores ranging from 1.54 to 2.41 for the items in the dimension 'Performance Anxiety' are shown in Table 4.10 (page 85). The highest mean score (2.41) was recorded by Item 9 'Having my science teacher ask me a question in class' and the lowest mean score (1.54) was given by Item 14 'Asking my science teacher a question about something I do not understand'. The overall item mean score of 1.94 with a standard deviation of .71 implies that the students had slight anxiety over how they performed in the science class that involved class interaction, doing a science project, or being watched when doing a laboratory procedure. Generally, they were more anxious of being asked a question by the science teacher in class than asking their science teacher things they did not understand.

4.3.6 Science Classroom Anxiety

As shown in Table 4.11 (page 86), the mean scores for the three items in the dimension 'Science Classroom Anxiety' are relatively low, ranging from 1.18 to 1.41. A majority of the students (87.8%, 70.3% and 85.1% respectively) rated their responses to Item 3, Item 7 and Item 32 as 'Not at all nervous'. Not even a single student rated his/her response as 'Very nervous'. Nevertheless, the overall item mean score of 1.26, with a standard deviation of .39 suggests that the students

were not anxious at all about being in the science classroom and listening to the lessons or doing the associated written work such as taking notes and doing science homework.

4.4   Top Ten Anxiety-contributing Activities for Students

To answer the Research Question 2 (see page 11), the results shown in Table 4.6 (page 81) to Table 4.11 (page 86) were extracted to produce a list of top ten anxiety-contributing activities, with the most anxiety-contributing activity assigned to the top. Table 4.12 shows that the mean scores of the top ten activities, ranging from 2.43 to 3.39, correspond to slightly and moderately nervous state of anxiety.

With a mean score of 3.39, 'Working with chemicals that are poisonous' was the most anxiety-contributing activity. This showed that the students were most anxious over activities in which they had to deal with poisonous chemicals.

'Using flammable chemicals' was the second most anxiety-contributing activity, with a mean score of 3.28. This activity was also a laboratory procedure involving chemicals.

Generally, the students were quite test-anxious. This was reflected by the third most anxiety-contributing activity of 'Taking the final examination for a science class'. This activity registered a mean score of 3.05 which corresponded to moderately nervous state of anxiety.

Table 4.12

Rank Order of Top Ten Anxiety-contributing Activities for Students

Rank Order	Anxiety-contributing Activity	Science Anxiety Score (N = 148)	
		Mean	Standard Deviation
1	Working with chemicals that are poisonous.	3.39	1.31
2	Using flammable chemicals.	3.28	1.26
3	Taking the final examination for a science class.	3.05	1.26
4	Using expensive glass apparatus in the laboratory.	2.93	1.16
5	Using hazardous chemicals, like acids in the laboratory.	2.80	1.23
6	Taking a science test.	2.69	.99
7	Working with an electrical power supply.	2.57	1.35
8	Studying for a science test.	2.45	1.21
9	Heating something with a bunsen burner.	2.43	1.20
9	Studying a fresh specimen of a cow's eye in the science class.	2.43	1.37

N denotes number of students involved

With a mean score of 2.93, 'Using expensive glass apparatus in the laboratory' was the fourth most anxiety-contributing activity of the students. A probable explanation for this phenomenon was that these students were afraid of being punished for breaking the glass apparatus.

Another activity associated with chemicals appeared again in the list of top ten anxiety-contributing activities. With a mean score of 2.80, 'Using hazardous chemicals, like acids in the laboratory' was the fifth most anxiety-contributing activity. This could reflect the anxiety of the students towards the potential hazards of the chemicals they worked with. When this result was compared to those of 'Working with chemicals that are poisonous' and 'Using flammable chemicals' which were the top two anxiety-contributing activities, it showed that the students perceived poisonous and flammable chemicals as more threatening than hazardous chemicals.

'Taking a science test' was the sixth most anxiety-contributing activity with a mean score of 2.69. Its rank order position was lower than the third anxiety-contributing activity 'Taking the final examination for a science class'. This showed that among the students, 'Taking the final examination for a science class' caused more anxiety than 'Taking a science test'.

The seventh most anxiety-contributing activity was 'Working with an electrical power supply' which gave a mean score of 2.57. This indicated that the students were generally worried about handling the electrical power supply in science laboratory. This could be due to their lack of experience in handling

electrical power supplies and their perception that all electrical equipment was dangerous.

In the present study, 'Studying for a science test' with a mean score of 2.45 was the eighth most anxiety-contributing activity. This indicated that the students were also anxious over studying for a science test. However, their anxiety in this aspect was less than the anxiety of sitting for a science test (the sixth most anxiety-contributing activity) or taking the final examination (the third most anxiety-contributing activity).

The ninth most anxiety-contributing activity was shared by 'Heating something with a bunsen burner' and 'Studying a fresh specimen of a cow's eye in the science class'. The former activity had a mean score of 2.43 with a standard deviation of 1.20 while the latter has the same mean but with a standard deviation of 1.37. Both the activities involved hands-on activities, although they were from different dimensions of anxiety in science learning.

To summarize, of the top ten anxiety-contributing activities shown in Table 4.12, six activities were within the dimension 'Danger Anxiety' (the first, second, fourth, fifth, seventh and ninth most anxiety-contributing activities), three activities were from the dimension 'Science Test Anxiety'(the third, sixth and eighth most anxiety-contributing activities), and one activity was from the dimension 'Squeamish Anxiety' (the ninth most anxiety-contributing activity). None of the activities were from the three other remaining dimensions of the SAI-A. These results implied that the students were particularly anxious over

potential dangers in science, followed by the science tests. The activity 'Studying a fresh specimen of a cow's eye in the science class' from the dimension 'Squeamish Anxiety' also contributed to science anxiety among the students.

The rank order of top ten anxiety-contributing activities for the male and female students were also determined in the present study. These rank orders were then compared to that of all subjects involved in this study. The comparisons, as shown in Table 4.13, indicate some similarities among the anxiety-contributing activities.

Four science-related activities were consistently found to be the top four anxiety-contributing activities of the students, regardless of the gender factor. This activities, in descending order of anxiety level, were : 'Working with chemicals that are poisonous', 'Using flammable chemicals', 'Taking the final examination for a science class' and 'Using expensive glass apparatus in the laboratory'. It is interesting to note that three out of the four activities were from the dimension 'Danger Anxiety'.

'Using hazardous chemicals, like acids in the laboratory' was the fifth most anxiety-contributing activity for all the subjects as well as for the male and females students. While this activity was the fifth most anxiety-contributing for the female students, 'Collecting cockroaches to use in an experiment' also appeared as their fifth most anxiety-contributing activity. However, this activity 'Collecting cockroaches to use in an experiment' was not in the list of top ten anxiety-contributing activities for all the subjects and for the male students.

Table 4.13

Comparisons of the Rank Order of Top Ten Anxiety-Contributing Activities

between All Subjects, Male and Female Students

Anxiety-contributing Activity	Rank Order (Mean)		
	All Subjects (N = 148)	Males (N = 70)	Females (N = 78)
Working with chemicals that are poisonous.	1 (3.39)	1 (3.24)	1 (3.53)
Using flammable chemicals.	2 (3.28)	2 (3.20)	2 (3.35)
Taking the final examination for a science class.	3 (3.05)	3 (2.90)	3 (3.18)
Using expensive glass apparatus in the laboratory.	4 (2.93)	4 (2.84)	4 (3.00)
Using hazardous chemicals, like acids in the laboratory.	5 (2.80)	5 (2.69)	5[©] (2.90)
Taking a science test.	6 (2.69)	6 (2.61)	8 (2.90)
Working with an electrical power supply.	7 (2.57)	7[+] (2.24)	7 (2.87)
Studying for a science test.	8 (2.45)		9 (2.69)
Heating something with a bunsen burner.	9* (2.43)		10 (2.62)
Studying a fresh specimen of a cow's eye in the science class.	9* (2.43)	9[#] (2.23)	

(table continues)

Table 4.13   (continued)

Anxiety-contributing Activity	Rank Order (Mean)		
	All Subjects (N = 148)	Males (N = 70)	Females (N = 78)
Collecting cockroaches to use in an experiment.			5© (2.90)
Collecting cheek cells to be observed with a microscope.		7+ (2.24)	
Having my science teacher ask me a question in class.		9# (2.23)	

N denotes number of students involved

* + # © denote activities which share the same rank order

'Taking a science test' was the sixth most anxiety-contributing activity for all the subjects involved in this study as well as for the male students. However, this activity was the eighth most anxiety-contributing activity for the female students.

The female students felt more nervous towards the handling of electrical power supplies than taking a science test. This can be seen from the trend that 'Working with an electrical power supply' was the seventh most anxiety-contributing activity while 'Taking a science test' was the eighth most anxiety-contributing activity for the female students. 'Working with an electrical power supply' was also the seventh most anxiety-contributing activity for all the subjects

and for the male students. For the male students, there was also another activity which was the seventh most anxiety-contributing activity. This activity was 'Collecting cheek cells to be observed with a microscope' from the dimension 'Squeamish Anxiety'. However, for all the subjects as well as for the female students, it did not appear as one of the top ten anxiety-contributing activities.

'Studying for a test' was the eighth most anxiety-contributing activity for all the subjects but the ninth most anxiety-contributing activity for the female students. However, this activity was not one of the top ten anxiety-contributing activities for the male students.

Likewise, 'Heating something with a bunsen burner' was the ninth most anxiety-contributing activity for all the subjects and the tenth most anxiety-contributing activity for the female students. However, it was not one of the top ten anxiety-contributing activities for the male students. Since this activity was related to 'Danger Anxiety', the difference between the male and female students in this activity could be explained by the nature of the males who were more confident and willing to take risk than the females (Kahle et al., 1983).

'Studying a fresh specimen of a cow's eye in the science class' was the ninth most anxiety-contributing activity for all the subjects and for the male students. Surprisingly, this activity was not one of the top ten anxiety-contributing activities for the female students. For the male students, 'Having my science teacher ask me a question in class' was also the ninth most anxiety contributing activity. This implied that the male students were quite anxious over

communicating in class when they were asked by the science teacher to answer questions. However, this activity was excluded from the list of top ten anxiety-contributing activities for all the subjects and for the female students.

4.5   Descriptive Statistics of Science Achievement Scores

Table 4.14 presents the descriptive statistics of science achievement scores obtained by the Form Two students. The full score is 50, but a mean score of 21.83 with a standard deviation of 6.01 was obtained in this study. The science achievement scores of the students range from 9.00 to 39.00, with a median of 22.00.

On the SAT, the male students scored from the lowest of 9.00 to the highest of 39.00, with a median of 21.00. The mean score is 21.60 with a standard deviation of 5.94. As for the female students, they obtained a mean score of 21.71 with a standard deviation of 5.96. In addition, their scores range from 9.00 to 37.00, with a median of 22.00.

Table 4. 14

Means, Standard Deviations, Medians, Maximums and Minimums of Science Achievement Scores

	Science Achievement		
	All Subjects (N = 148)	Males (N = 70)	Females (N = 78)
Mean	21.83	21.60	21.71
Standard Deviation	6.01	5.94	5.96
Median	22.00	21.00	22.00
Minimum	9.00	9.00	9.00
Maximum	39.00	39.00	37.00

N denotes number of students involved

4.6 Descriptive Statistics of Scores for Attitude towards Science

The students' attitude towards science as assessed by the ATSSA is reflected by the scores shown in Table 4.15. The high scores attained in the ATSSA implied that the Form Two students generally had a positive attitude towards science. The mean score is 58.00 with a standard deviation of 7.32. The minimum and maximum scores are 35.00 and 70.00 respectively, while the median is 59.00.

The male students obtained a mean score of 57.54 with a standard deviation of 6.83. Their scores range from 40.00 to 70.00, with a median of 58.00. The mean score of the female students is slightly higher than that of the male students. It is 58.41, with a standard deviation of 7.76. Their scores range from 35.00 to 70.00, with a median of 59.00.

Table 4. 15

Means, Standard Deviations, Medians, Maximums and Minimums of Scores for Attitude towards Science

	Attitude towards Science		
	All Subjects (N = 148)	Males (N = 70)	Females (N = 78)
Mean	58.00	57.54	58.41
Standard Deviation	7.32	6.83	7.76
Median	59.00	58.00	59.00
Minimum	35.00	40.00	35.00
Maximum	70.00	70.00	70.00

N denotes number of students involved

4.7   Relationship of Science Anxiety with Science Achievement

The statistics of t-test was employed to examine the relationship between science anxiety and science achievement, with science anxiety as the independent variable and science achievement as the dependent variable. For the purpose of the t-test analyses, two distinct groups of students were identified as the high and low anxiety groups according to their science anxiety scores on the SAI-A and its dimensions. According to the operational definition shown in page14, the high anxiety group was made up of the top 30% of students while the low anxiety group comprised the lowest 30% of students based on their SAI-A scores. Table 4.16 shows the results of the t-test analyses.

For the overall science anxiety, the mean score achieved by the high anxiety group was 19.30 with a standard deviation of 5.55, while the low anxiety group obtained a mean score of 23.38 with a standard deviation of 6.14. The t-value of -3.15 was significant at $p < .01$. This implied that the students from the high anxiety group showed significantly lower science achievement than the students in the low anxiety group.

Further t-test analyses involving the six SAI-A dimensions revealed significant differences on science achievement scores between the high and low anxiety groups for the dimensions 'Danger Anxiety', 'Math and Problem-solving Anxiety', 'Squeamish Anxiety', and 'Performance Anxiety'.

Table 4.16

t-test Comparisons between High and Low Anxiety Groups on Their Science Achievement Scores

SAI-A Dimension	Science Achievement		*t*-test	
	High Anxiety Group (N = 44)	Low Anxiety Group (N= 44)	*t*	*p*
Danger Anxiety				
Mean	18.68	24.05	-4.22	Significant
Standard Deviation	5.20	6.63		*p* < .001
Science Test Anxiety				
Mean	20.23	22.36	-1.69	not
Standard Deviation	5.10	6.69		significant*
Math and Problem-solving Anxiety				
Mean	19.82	22.93	-2.44	significant
Standard Deviation	5.42	6.52		*p* < .05
Squeamish Anxiety				
Mean	20.48	23.53	-2.23	significant
Standard Deviation	6.44	6.39		*p* < .05
Performance Anxiety				
Mean	20.07	23.23	-2.48	significant
Standard Deviation	6.44	6.67		*p* < .05
Science Classroom Anxiety				
Mean	20.66	22.73	-0.63	not
Standard Deviation	5.34	6.47		significant*
Overall Science Anxiety				
Mean	19.30	23.38	-3.15	significant
Standard Deviation	5.55	6.14		*p* < .01

N denotes number of students involved and * denotes not significant at *p* < .05

For 'Danger Anxiety', the mean score of the high anxiety group was 18.68 with a standard deviation of 5.20, and the mean score of the low anxiety group was 24.05 with a standard deviation of 6.63. The t-value of -4.22 was significant at $p < .001$. This indicated that the students in the high anxiety group with respect to 'Danger Anxiety' had significantly lower science achievement scores compared to those in the low anxiety group.

The t-test computed for the high and low anxiety groups on the dimension 'Math and Problem-solving Anxiety' also yielded a significant result, in which the t-value of -2.44 was significant at $p < .05$. The mean score of the high anxiety group was 19.82 with a standard deviation of 5.42, while the mean score of the low anxiety group was 22.93 a standard deviation of 6.52. The result indicated a negative relationship between the anxiety in the dimension 'Math and Problem-solving Anxiety' and science achievement, in that the students from the high anxiety group scored significantly lower on the SAT than those from the low anxiety group.

For the dimension 'Squeamish Anxiety', the high anxiety group obtained a mean score of 20.48 with a standard deviation of 6.44, and for the low anxiety group the mean score was 23.53 with a standard deviation of 6.39. The t-value of -2.23 was significant at $p < .05$. This implied that the students in the high anxiety group on 'Squeamish Anxiety' showed significantly poorer science achievement than those in the low anxiety group.

Likewise, the students who were in the high anxiety group for the dimension 'Performance Anxiety' also showed significantly lower science achievement than the students in the low anxiety group.

As for the dimensions 'Science Test Anxiety' and 'Science Classroom Anxiety', no significant differences were found at $p < .05$. The results implied that the students from the high and low anxiety groups for the dimension 'Science Test Anxiety' and 'Science Classroom Anxiety' did not differ significantly in their science achievement scores.

The above findings indicated that there were significant negative relationships for the variables of the overall science anxiety with science achievement, 'Danger Anxiety' with science achievement, 'Math and Problem-solving Anxiety' with science achievement, 'Squeamish Anxiety' with science achievement, and 'Performance Anxiety' with science achievement. No significant relationships were found for 'Science Test Anxiety' with science achievement, and for 'Science Classroom Anxiety' with science achievement.

The negative relationship found in this study for the overall science anxiety and science achievement was consistent with the studies carried out in the United States by Chiarelott et al. (1987), Czerniak et al. (1984, 1985), Westerback et al. (1985), Wynstra (1991), and Yurkewicz (1988).

The finding that there was no significant relationship between science test anxiety and science achievement was contrary to the findings of Zoller et al. (1988) who reported a negative correlation between test anxiety and academic

achievement. However, the findings on the relationships of other dimensions of science anxiety with science achievement could not be compared to any other findings since the researcher could not trace any previous study that had probed into these relationships.

4.8   Relationship of Science Anxiety with Attitude towards Science

In determining the relationship of science anxiety with attitude towards science, t- tests were carried out to test the significant differences between the high and low anxiety groups on their mean ATSSA scores. Table 4.17 shows the t-test comparisons between the high and low anxiety groups on their scores for attitude towards science.

For the overall science anxiety, the mean score of the high anxiety group was 57.11 with a standard deviation of 7.28, while the mean score of the low anxiety group was 60.66 with a standard deviation of 6.46. The t-value of -2.42 was significant at $p < .05$. The result implied that the students in the high anxiety group for the overall anxiety showed significantly less positive attitude towards science compared to those in the low anxiety group.

Table 4.17

***t*-test Comparisons between High and Low Anxiety Groups on Their ATSSA Scores**

SAI-A Dimension	Attitude towards Science		*t*-test	
	High Anxiety Group (N = 44)	Low Anxiety Group (N = 44)	*t*	*p*
Danger Anxiety				
Mean	56.98	60.68	-2.41	significant
Standard Deviation	7.64	6.73		*p* < .05
Science Test Anxiety				
Mean	56.80	59.55	-1.70	not
Standard Deviation	7.72	7.44		significant*
Math and Problem-solving Anxiety				
Mean	57.95	59.70	-1.16	not
Standard Deviation	6.95	7.26		significant*
Squeamish Anxiety				
Mean	57.73	60.14	-1.59	not
Standard Deviation	7.10	7.10		significant*
Performance Anxiety				
Mean	56.41	58.95	-1.54	not
Standard Deviation	6.90	8.53		significant*
Science Classroom Anxiety				
Mean	57.23	59.18	-1.20	not
Standard Deviation	7.51	7.74		significant*
Overall Science Anxiety				
Mean	57.11	60.66	-2.42	significant
Standard Deviation	7.28	6.46		*p* < .05

N denotes number of students involved and * denotes not significant at *p* < .05

For the dimension 'Danger Anxiety', a significant difference between the high and low groups on the attitude towards science scores could also be seen. The high anxiety group obtained a mean score of 56.98 with a standard deviation of 7.64 whereas the low anxiety group had a mean score of 60.68 with a standard deviation of 6.73. The t-value of -2.41 was significant at $p < .05$. This implied that the students in the high anxiety group on 'Danger Anxiety' had significantly less positive attitude towards science than those in the low anxiety group.

For the other SAI-A dimensions comprising 'Science Test Anxiety', 'Math and Problem-solving Anxiety', 'Squeamish Anxiety', 'Performance Anxiety', and 'Science Classroom Anxiety', there were no significant differences between the high and low anxiety groups in their attitude towards science at $p < .05$.

This study has discovered that there existed significant negative relationships of the overall science anxiety with attitude towards science, and of 'Danger Anxiety' with attitude towards science. No significant relationships were found for 'Science Test Anxiety', 'Math and Problem-solving Anxiety', 'Squeamish Anxiety', 'Performance anxiety' and 'Science Classroom Anxiety' with attitude towards science. Since the researcher could not trace any other study on the relationships of the specific dimensions of science anxiety with the single dimension of attitude towards science, the present findings on the relationship between the specific dimensions of science anxiety with attitude towards science could not be compared with the findings of other studies.

However, studies had been carried out to relate the overall science anxiety with attitudes about science. The finding of the present study regarding the significant negative relationship between the overall science anxiety with attitude towards science was consistent with the results of the following studies. In Wynstra's (1991) study, the liking of science classes, interest in science topics and the amount of time interacting with materials were found to be negatively correlated to science anxiety of high school students. In the studies conducted by Chiarelott et al. (1986) and by Westerback (1982) which involved experienced teachers and preservice teachers respectively, it was found that attitude towards teaching science was negatively related to their anxiety levels of teaching science.

4.9   Relationship of Science Anxiety with Gender

To establish the relationship of science anxiety with gender, t-test analyses were applied to the mean total scores of the male and female students on the SAI-A and its dimensions. Table 4.18 presents the t-tests results on the mean total score of the overall science anxiety and the SAI-A dimensions.

For the overall science anxiety, the mean total score for the male students was 76.54 with a standard deviation of 19.44 while the female students obtained a mean total score of 86.64 with a standard deviation of 23.13. The t-value of -2.86 was significant at $p < .01$. Hence the higher mean total score obtained by the

Table 4.18

t-test Comparisons between Male and Female Students on their Science

Anxiety Scores

SAI-A Dimension	Science Anxiety		*t*-test	
	Males (N = 70)	Females (N= 78)	*t*	*p*
Danger Anxiety				
Mean	20.43	23.00	-2.25	significant
Standard Deviation	6.72	7.16		$p < .05$
Science Test Anxiety				
Mean	15.24	17.15	-2.38	significant
Standard Deviation	4.44	5.23		$p < .05$
Math and Problem-solving Anxiety				
Mean	10.83	12.23	-2.29	significant
Standard Deviation	3.44	3.97		$p < .01$
Squeamish Anxiety				
Mean	13.50	16.19	-2.82	significant
Standard Deviation	4.87	6.52		$p < .01$
Performance Anxiety				
Mean	12.73	14.33	-1.99	significant
Standard Deviation	4.03	5.57		$p < .01$
Science Classroom Anxiety				
Mean	3.81	3.73	.44	not
Standard Deviation	1.25	1.08		significant*
Overall Science Anxiety				
Mean	76.54	86.64	-2.86	significant
Standard Deviation	19.44	23.13		

N denotes number of students involved and * denotes not significant at $p < .05$

female students implied that the female students had a higher level of overall science anxiety than their male counterparts.

The dimension 'Danger Anxiety' registered a mean total score of 20.43 with a standard deviation of 6.72 for the male students, and a mean total score 23.00 with a standard deviation of 7.16 for the female students. The t-value of -2.25 was significant at $p < .05$. This implied that the female students had a higher level of 'Danger Anxiety' when compared to the male students.

The mean total score on the dimension 'Science Test Anxiety' of the male students was 15.24 with a standard deviation of 4.44. For the female students, the mean total score was 17.15 with a standard deviation of 5.23. The t-value of -2.38 was significant at $p < .05$. The result implied that the female students had a significantly higher level of science test anxiety than the male students.

For the dimension 'Math and Problem-solving Anxiety', the mean total score of the male students was 10.83 with a standard deviation of 3.44. The mean total score of the female students was 12.23 with a standard deviation of 3.97. The t-value of -2.29 was significant at $p < .01$. The result indicated that the scores on 'Math and Problem-solving Anxiety' between the male and female students differed significantly. The female students were significantly more anxious over the aspect of math and problem-solving in science than their male counterparts.

For the dimension 'Squeamish Anxiety', the male students had a mean total score of 13.50 with a standard deviation of 4.87, while the female students had a mean total score of 16.19 with a standard deviation of 6.52. The t-value of -2.82

was significant at $p < .01$. Thus, the higher mean total score of the females implied that their 'Squeamish Anxiety' was significantly higher than that of the male students.

Subsequent *t*-test analysis on the dimension 'Performance Anxiety' indicated a significant difference between the mean total score obtained by the male and female students. The mean total score of the male students was 12.73 with a standard deviation of 4.03. For the female students, the mean total score and standard deviation were 14.33 and 5.57 respectively. The *t*-value of -1.99 was significant at $p < .01$. This implied that the female students had a significantly higher level of 'Performance Anxiety' than the male students.

As for the dimension 'Science Classroom Anxiety', the mean total score of the male students was 3.81 with a standard deviation of 1.25, which was slightly higher than the mean total score of 3.73 and a standard deviation of 1.08 obtained by the female students. However, the *t*-value of .44 was not significant at $p < .05$. This implied that the male and female students did not differ significantly in their 'Science Classroom Anxiety'.

To summarize, the results of the *t*-test analyses implied that the female students had significantly higher levels of the overall science anxiety, 'Danger Anxiety', 'Science Test Anxiety', 'Math and Problem-solving Anxiety', 'Squeamish Anxiety' and 'Performance Anxiety' as compared to their male counterparts.

The above findings were consistent with those of Wynstra (1991) and Foo (1996) who utilised the SAI and a modified version of SAI respectively in their studies. Both the studies reported that the females were consistently more anxious in overall science anxiety and all its components except in 'Science Classroom Anxiety'.

The findings of the present study also supported the previous studies which found significant gender differences in science anxiety where the female students seemed to be significantly more anxious (Chiarelott et al., 1987; Czerniak et al., 1984, 1985; Hensley, 1996; Mallow, 1994; Meissner, 1988; Wynstra et al., 1990).