CHAPTER 4

RESULTS AND INTERPRETATIONS

4.0 Introduction

The data collected were processed by using the Statistical Package for the Social Sciences, SPSS (Norusis, 1990). The following statistical techniques were employed in the analysis of the data :

(a) Item-total correlations of the SLEI subscales and the ATSSA scale.

(b) Cronbach alpha reliability coefficients for the five SLEI subscales and for the ATSSA.

(c) K-R 20 coefficient of the SAT.

(d) Descriptive statistics of the students' overall perception of the science laboratory environment as measured by the SLEI and its subscales.

(e) Pearson product-moment correlations between the students' overall SLEI scores, SLEI subscale scores and the dependent variable of

(i) achievement in science, and

(ii) attitude toward science.

(f) *t*-test comparisons between the boys' and girls' mean overall SLEI scores and the SLEI subscale mean scores for all the subjects of the study and for each class.

4.1 Item-total Correlations of SLEI Subscales and ATSSA Scale.

Item-total correlations were computed for each SLEI subscale and the ATSSA scale. The purpose of computing the item-total correlations was to establish whether the items were contributing significantly to their respective subscales. This computation involves the correlation between the score of each item in a subscale with the total score of all the items in that subscale.

Table 4.1 shows that the item-total correlations for the SLEI items are greater than .3 and are significant at $p <$ .001 except for Items 9, 24 and 27 which have item-total correlations of less than .3. Therefore, Item 27 from the subscale Open-endedness and Items 9 and 24 from the subscale Rule Clarity were excluded from their respective subscales (Kempa, 1986; Swetz, 1982).

As shown in Table 4.2, the item-total correlations of all the items in the ATSSA are significant at $p <$ .001 with values greater than .3. This indicates that all the items are contributing significantly to the single construct of the ATSSA.

Table 4.1

Item-total Correlations of SLEI Subscales

Items of Subscale			Item-total Correlation
Subscale	**:**	**Student Cohesiveness**	
Item 1	:	Pelajar dalam kelas makmal ini dapat bergaul dengan baik sebagai satu kumpulan.	.61**
Item 6	:	Pelajar-pelajar mempunyai peluang yang terhad untuk berkenalan antara satu sama lain dalam makmal sains	.35**
Item 11	:	Pelajar-pelajar dalam kelas makmal ini saling membantu antara satu sama lain.	.67**
Item 16	:	Pelajar-pelajar kelas makmal ini berkenalan di antara satu sama lain dengan baik.	.64**
Item 21	:	Pelajar-pelajar boleh mengharapkan antara satu sama lain sekiranya mereka memerlukan bantuan semasa kelas makmal sains dijalankan.	.45**
Item 26	:	Pelajar-pelajar mengambil masa yang panjang untuk berkenalan antara satu sama lain dalam makmal sains.	.45**
Item 31	:	Pelajar-pelajar bekerjasama dalam sesi makmal.	.73**
Subscale	**:**	**Open-endedness**	
Item 2	:	Terdapat peluang untuk pelajar mengembangkan minat mereka terhadap sains dalam kelas makmal ini.	.34**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

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Item 7	:	Dalam kelas makmal ini, kami dikehendaki merangka eksperimen kami sendiri untuk menyelesaikan masalah yang diberi.	.49**
Item 12	:	Dalam sesi makmal kami, setiap pelajar mengumpul data-data yang berlainan untuk eksperimen yang sama.	.45**
Item 17	:	Pelajar-pelajar dibenarkan melakukan latihan tambahan selain daripada latihan makmal biasa dan pelajar boleh menjalankan eksperimen mereka sendiri.	.54**
Item 22	:	Dalam kelas makmal, setiap pelajar menjalankan eksperimen yang berlainan.	.46**
Item 27	:	Dalam sesi makmal, guru memutuskan cara yang terbaik untuk menjalankan eksperimen.	.22**
Item 32	:	Pelajar-pelajar memutuskan cara yang terbaik untuk menjalankan eksperimen semasa sesi makmal.	.37**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

Subscale	:	**Integration**	
Item 3	:	Apa yang kami pelajari dalam kelas teori sains tidak berkaitan dengan kerja makmal kami.	.52**
Item 8	:	Kerja makmal tidak berkaitan dengan topik-topik yang kami pelajari dalam kelas teori sains.	.67**
Item 13	:	Kerja kelas teori sains kami disepadukan dengan aktiviti makmal.	.50**
Item 18	:	Kami menggunakan teori yang kami pelajari dalam kelas sains semasa menjalankan aktiviti makmal.	.60**

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Item 23	:	Topik-topik yang dipelajari dalam kelas teori sains agak berbeza daripada topik-topik yang dipelajari dalam kelas makmal.	.48**
Item 28	:	Apa yang kami lakukan semasa sesi makmal menolong kami memahami teori yang dipelajari dalam kelas teori sains.	.58**
Item 33	:	Kerja makmal sains dan latihan teori sains tidak berkaitan.	.56**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

Subscale	:	**Rule Clarity**	
Item 4	:	Terdapat peraturan-peraturan yang jelas untuk membimbing kami menjalankan aktiviti dalam kelas makmal kami.	.51**
Item 9	:	Kerja makmal ini agak tidak rasmi dan hanya terdapat beberapa peraturan yang perlu diikuti oleh pelajar.	.27**
Item 14	:	Pelajar-pelajar dikehendaki mematuhi peraturan-peraturan tertentu dalam makmal.	.51**
Item 19	:	Terdapat satu cara yang telah ditetapkan untuk kami menjalankan eksperimen dengan selamat dalam makmal ini.	.54**
Item 24	:	Terdapat sedikit peraturan tetap yang harus dipatuhi oleh pelajar dalam kelas makmal.	.00
Item 29	:	Guru memberi garis panduan tentang langkah-langkah keselamatan sebelum sesi makmal bermula.	.48**

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Item 34	:	Kelas amali dijalankan dengan peraturan yang lebih jelas daripada kelas-kelas mata pelajaran yang lain.	.45**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

Subscale	:	**Material Environment**	
Item 5	:	Makmal kami sesak semasa kami menjalankan eksperimen.	.51**
Item 10	:	Radas dan bahan yang diperlukan oleh pelajar-pelajar untuk aktiviti makmal mudah didapati.	.51**
Item 15	:	Pelajar-pelajar rasa malu dengan keadaan fizikal makmal ini.	.59**
Item 20	:	Radas-radas makmal berada dalam keadaan yang kurang baik.	.62**
Item 25	:	Suasana makmal sains adalah panas dan menyesakkan.	.61**
Item 30	:	Makmal sains adalah tempat yang menarik untuk melakukan kerja amali.	.48**
Item 35	:	Makmal kami mempunyai ruang yang mencukupi untuk melakukan kerja secara individu atau berkumpulan.	.51**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

Table 4.2
Item-total Correlations of ATSSA

Items of the ATSSA				Item-total Correlation
Item	1	:	Sains menyeronokkan.	.61**
Item	2	:	Saya tidak suka sains dan saya rasa mempelajari sains sesuatu yang menyusahkan.	.60**
Item	3	:	Saya berminat mengikuti kelas sains.	.64**
Item	4	:	Saya ingin mengetahui dengan lebih mendalam mengenai sains.	.64**
Item	5	:	Jika saya diberitahu bahawa saya tidak akan menghadiri kelas sains lagi, saya akan rasa sedih.	.47**
Item	6	:	Sains adalah menarik dan saya dapat menikmati mata pelajaran tersebut.	.61**
Item	7	:	Sains membuat saya tidak selesa, gelisah, resah dan tidak sabar.	.50**
Item	8	:	Sains mengagumkan dan menyeronokkan .	.68**
Item	9	:	Perasaan saya terhadap sains adalah perasaan yang baik.	.66**
Item	10	:	Apabila mendengar perkataan sains, saya ada perasaan tidak suka tentang mata pelajaran sains.	.57**
Item	11	:	Sains adalah satu mata pelajaran yang seronok saya pelajari.	.70**
Item	12	:	Saya rasa selesa dengan sains dan saya sangat suka akan mata pelajaran tersebut.	.70**
Item	13	:	Saya mempunyai reaksi yang amat positif terhadap sains.	.60**
Item	14	:	Sains menjemukan.	.63**

* denotes one-tailed significant at $p < .01$
** denotes one-tailed significant at $p < .001$

Table 4.3

Item-total Correlations of SLEI Subscales Open-endedness and Rule Clarity after Deleting Items 9, 24 and 27.

Item	Item-total Correlation
Subscale : Open-endedness	
Item 2	.44**
Item 7	.51**
Item 12	.48**
Item 17	.54**
Item 22	.41**
Item 32	.44**
Subscale : Rule Clarity	
Item 4	.55**
Item 14	.62**
Item 19	.67**
Item 29	.58**
Item 34	.51**

Subsequent analysis of the data would be based on all the items of the instrument ATSSA. However, for the SLEI, further analysis would involve all the items except Items 9, 24 and 27 which were deleted from their respective SLEI subscales. Item-total correlations for the remaining items in the SLEI subscales Open-endedness and Rule Clarity were computed once again and the results are presented in Table 4.3.

With the deletion of the Items 9, 24 and 27, the remaining 32 SLEI items have item-total correlations ranging from .34 to .73 which are significant at $p < .001$.

All the items in the ATSSA are retained and their item-total correlations range from .47 to .70 and are significant at $p < .001$.

The results of the correlational analysis indicate that the scores of most of the items of the SLEI and the ATSSA are satisfactorily consistent with the total scores of the SLEI subscales and the ATSSA respectively.

Table 4.4

Cronbach Alpha Coefficients of SLEI Subscales in Three Studies

SLEI Subscale	Cronbach Alpha Reliability Coefficient		
	Present Study	Study of Chan (1995)	Study of Fraser et al. (1993)
Student Cohesiveness	.66	.73	.56 - .81
Open-endedness	.29	.42	.49 - .78
Integration	.64	.67	.65 - .89
Rule Clarity	.51	.55	.61 - .84
Material Environment	.61	.72	.56 - .83

4.2 Cronbach Alpha Reliability of the SLEI

Table 4.4 presents the Cronbach alpha coefficients of the SLEI subscales for the present study which range from .29 to .66. The alpha reliability coefficients of the subscales Student Cohesiveness and

Material Environment were .66 and .61 respectively. These values were found to be within the ranges of the alpha reliability coefficients reported by Fraser et al. (1993). However, for the subscales Open-endedness (α = .29), Rule Clarity (α = .51), and Integration (α = .64), the alpha reliability coefficients were slightly lower than those reported by Fraser et al. (1993). The reliability coefficient analysis showed that Cronbach alpha coefficients for all the subscales obtained in this study were also slightly lower than that reported by Chan (1995). However, there was a similarity between the alpha coefficients of this study and that reported by Chan (1995). For both the studies, the alpha coefficients for the subscales Open-endedness and Rule Clarity were found to be lower than that reported by Fraser et al. (1993).

4.3 Cronbach Alpha Reliability of the ATSSA

For this study, the Cronbach alpha reliability of the ATSSA was found to be .87 as compared to the reliability estimate of .95 that was reported by Germann (1988).

The results of the reliability analysis performed on the SLEI and ATSSA indicated that the subscales of the SLEI and the ATSSA had satisfactory internal consistency and hence were considered to be reliable.

4.4 Reliability of the SAT

For this study, the reliability of the SAT was estimated by using the K-R 20 formula. After the SAT was administered to all the subjects in the study, the students' response were analysed and scored. Based on the proportion of the correct responses for each item of the SAT, sample variance and the number of items in the test, the value of the K-R 20 coefficient was computed to be .84. According to Ng (1991), K-R 20 reliability estimates that are less than .80 for achievement tests are considered unsatisfactory. Thus, the SAT was considered to have satisfactory internal consistency and hence was reliable.

4.5 Descriptive Statistics of Overall Perception of Science Laboratory Environment of Form Two Students

The mean score for each of the item of the overall SLEI and the individual subscales were computed and examined in terms of their means, standard deviations, medians, minimums, and maximums. Table 4.5 presents the descriptive statistics of the SLEI and its subscales.

As shown in Table 4.5, for all the subjects of the study, the mean score for each item is 3.56 with a standard deviation of 0.42. The overall SLEI has a median of 3.63 and ranges from a minimum of 2.44 to a maximum of 4.50.

Table 4.5

Means, Standard Deviations, Medians, Minimums, and Maximums of Overall Score of SLEI and its Subscales.

	Overall Percep-tion	Student Cohesive-ness	Open-end edness	Integra-tion	Rule Clarity	Material Environ-ment
Mean *	3.56	3.66	2.85	3.75	3.77	3.75
Standard Deviation	0.42	0.63	0.53	0.67	0.67	0.63
Median	3.63	3.71	2.83	3.71	3.80	3.86
Minimum	2.44	1.29	1.67	1.86	1.80	1.86
Maximum	4.5	4.50	5.00	5.00	5.00	5.00

* mean refers to the mean score per item

For the subscale Student Cohesiveness, the mean is 3.66 with a standard deviation of 0.63. The median for this subscale is 3.71 while the range is from a minimum of 1.29 to a maximum of 5.00. The subscale Integration has a mean of 3.75 with a standard deviation of 0.67. The range for this subscale is from 1.86 to 5.00 with a median of 3.71. As for Rule Clarity subscale, the mean is 3.77 and the standard deviation is 0.67. The Rule Clarity subscale has a median of 3.80 and ranges from a minimum of 1.80 to a maximum of 5.00. The mean for the subscale Material Environment is found to be 3.75 with a standard deviation of

Material Environment is found to be 3.75 with a standard deviation of 0.63. The median is 3.86 while the range is from a minimum of 1.86 to a maximum of 5.00 which is similar to that found for Integration subscale. The data also show that the Open-endedness subscale has the lowest mean of 2.85 with a standard deviation of 0.53. The median is 2.83 and the range is from 1.67 to 4.50. This finding is consistent with the results reported by Fraser et al. (1993, 1995) who found that the mean score on the actual version of the Open-endedness subscale was extremely low relative to the other four SLEI dimensions.

Based on the results presented in Table 4.5, the rank order of the students' perception of their science laboratory environment according to the SLEI subscales was found to be as follows:

Rule Clarity > Integration > Material Environment >
(3.77) (3.75) (3.75)

Student Cohesiveness > Open-endedness.
(3.56) (2.85)

The rank order indicates that in terms of mean score per item, Rule Clarity subscale has the highest score while the subscale Open-endedness has the lowest score.

Based on the scaling of 1 to 5 to indicate how often each of the SLEI item takes place in the laboratory, where 1 refers to 'Almost Never', 2 to

Seldom', 3 to 'Sometimes', 4 to 'Often' and 5 to 'Very often', these results suggest that the students found that their behaviour in the laboratory was quite often guided by formal rules. They perceived that their laboratory activities were integrated with nonlaboratory and theory classes, and that the laboratory equipment and materials were often adequate. The results also indicate that the students perceived that there was often student cohesiveness in their laboratory classes. However, the results show that the students perceived that their laboratory classes were only sometimes open-ended.

The mean of 3.77 for the subscale Rule Clarity is found to be within the range of means (3.64 to 4.19) for the same subscale of the four different physics classes reported by Chan (1995). For this study, the means for the subscales Open-endedness, Rule Clarity, and Material Environment were 2.85, 3.77 and 3.75 respectively . These means were found to be higher than the means of Open-endedness (2.22 - 2.47), Rule Clarity (3.54 - 3.75) and Material Environment (3.48 - 3.79) found by Chan (1995) in her study. However, for Integration the mean of 3.75 was found to be lower than the range of means from 3.92 to 4.09 for the same subscale as found by Chan (1995) in her study,

4.6 Relationship between Science Achievement and Form Two Students' Perception of Science Laboratory Environment

The mean scores of the students' overall perception of their science laboratory environment as measured by the SLEI and its subscales were correlated with science achievement. The correlation matrix is presented in Table 4.6.

The results of the analysis show that the students' overall perception of their science laboratory environment has a correlation of .41 with science achievement. This is significant at $p < .001$. This implies that the students' overall perception of the science laboratory environment was significantly related to the students' academic achievement in science.

The data also show that science achievement is significantly related to science laboratory environment perception of Student Cohesiveness ($r = .33$, $p < .001$), Integration ($r = .49$, $p < .001$), Rule Clarity ($r = .35$, $p < .001$), and Material Environment ($r = .19$, $p < .01$).

However, as shown in Table 4.6, the correlation obtained for science achievement with the science laboratory perception of Open-endedness is not significant at $p < .05$. This result is consistent with the findings of Fraser et al. (1993) in that all the subscales of SLEI except for Open-endedness were positively correlated with the learning outcomes measured by two inquiry skill scales in chemistry. It should be noted that

Table 4.6

Correlation Matrix: Science Achievement and Attitude toward Science with Students' Perception of Science Laboratory Environment

SLEI Scale	Science Achievement	Attitude Toward Science
Overall Perception	.41**	.40**
Student Cohesiveness	.33**	.35**
Open-endedness	- .03	.10
Integration	.49**	.30**
Rule Clarity	.35**	.29**
Material Environment	.19*	.26**

Number of cases: 255
* denotes 1-tailed significant at $p <$ .01
** denotes 1-tailed significant at $p <$ .001

Fraser et al. (1993) only reported the correlations which were either positive or negative without mentioning the numerical values of the correlations.

The results of the present study suggest that students who had higher perception of Open-endedness tended to obtain lower scores in their science achievement test. The findings also indicate that the students who

viewed the laboratory environment positively (that is, they found the environment more cohesive, the activities often integrated with theory classes, the laboratory often adequately equipped and that their activities were guided by formal laboratory rules) were the students who performed better academically in science.

4.7 Relationship between Attitude toward Science and Form Two Students' Perception of Science Laboratory Environment

The results show that the correlation of overall SLEI score with attitude toward science is .40 and is significant at $p < .001$ (see Table 4.6).

As shown in Table 4.6, attitude toward science has correlations of .35, .30, .29, and .26 with Student Cohesiveness, Integration, Rule Clarity and Material Environment respectively and these correlations are significant at $p < .001$. However, the data show that the .10 correlation between Open-endedness and attitude toward science is not significant. With respect to all the subscales except for Open-endedness, it was found that these results were consistent with the findings of Fraser et al. (1993, 1995). However for the subscale Open-endedness, Fraser et al. (1993, 1995) found that it was negatively related to attitude toward science, whereas in this study it was found that the correlation was positive even though the value was very small ($r = .10$).

The results of the present study suggest that: (i) a more cohesive class, (ii) a class where activities were more integrated with the theory classes, (iii) a class where more formal rules guide laboratory activities, and (iv) a class with adequate equipment and materials, were related to better student attitude toward science. However, an open-ended, divergent approach to experimentation was very weakly related to attitude toward science.

4.8 Gender Differences in Form Two Students' Perception of Science Laboratory Environment

t-tests were employed to test for significant differences in the mean total scores for the overall perception of the science laboratory environment and the SLEI subscales Student Cohesiveness, Open-endedness, Integration, Rule Clarity, and Material Environment obtained by the boys and the girls. In addition, *t*-test analysis of the means of the boys and the girls were also carried out for each of the Form Two classes except for Form 2 Amanah. This was because in Form 2 Amanah there were only fifteen students (5 boys and 10 girls) who completed the questionnaires.

Table 4.7

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment.**

SLEI Subscale	Student Perceptions (N = 255)		*t*-test	
	Boys (N=133)	Girls (N=122)	*t*	*p*
Overall				
Mean	111.89	116.38		
Standard Deviation	13.13	13.30	-2.71	n.s.
Student Cohesiveness				
Mean	25.09	26.13	-1.88	n.s.
Standard Deviation	4.66	4.14		
Open-endedness				
Mean	17.45	16.68	1.91	n.s.
Standard Deviation	3.02	3.35		
Integration				
Mean	25.43	27.16	-3.18	sig.
Standard Deviation	3.98	4.74		$p < .01$
Rule Clarity				
Mean	18.29	19.48	-2.86	sig.
Standard Deviation	3.49	3.13		$p < .01$
Material Environment				
Mean	25.62	26.91	-2.33	sig.
Standard Deviation	4.29	4.52		$p < .05$

n.s. denotes not significant at .05 level
N denotes number of students

As shown in Table 4.7, for the overall mean total score of the SLEI, the boys had a mean total score of 111.89 with a standard deviation of 13.13 as compared to a mean total score of 116.38 with a standard deviation of 13.30 for the girls. The *t*-value of -2.71 is not significant at $p < .05$ and hence the results indicate that there is no significant difference between the mean scores of the boys and that of the girls. This implies that there was no significant difference in the overall perception of the science laboratory environment of the boys and the girls.

Although the overall perception of the boys and girls did not differ significantly, further *t*-test analysis detected significant differences in the perception of Integration, Rule Clarity, and Material Environment. As shown in Table 4.7, for the subscale Integration, the boys' mean total score is 25.43 while that of the girls is 27.16. The results of the *t* test analysis indicate that the mean scores for the boys and the girls are significantly different at $p < .01$ for Integration. This implies that the girls' perception of Integration was significantly higher than that of the boys'. This is similar to the findings reported by Fraser et al. (1995). They found that gender difference was significant at $p < .05$ for the same subscale Integration and that the girls' mean score was significantly higher than that of the boys'.

The data also show that the girls had significantly higher mean scores than the boys in their perception of Rule Clarity ($p < .01$) and Material

Environment ($p < .05$). This finding is contrary to the findings by Fraser et al. (1995) where they found that there were no significant gender differences for Rule Clarity and Material Environment.

In this study, the *t*-test analysis of the means obtained by the boys and the girls for the subscales Student Cohesiveness and Open-endedness show that the *t*-values are not significant at $p < .05$. Both the boys and the girls had similar perception regarding the extent to which the students would work cooperatively in the laboratory. However, on the other hand, findings by Lawrenz (1987) and Fraser et al. (1995) indicated that there was significant gender difference for the perception of Student Cohesiveness. They found that the girls viewed their classes as significantly more cohesive than the boys. The boys and the girls also had similar perception with respect to open-endedness approach in conducting laboratory activities. In the study by Fraser et al. (1995), similar findings of no significant gender difference was found for the perception of Open-endedness.

Hence, the findings of this study where significant gender differences were found for the perception of Integration, Rule Clarity, and Material Environment are contrary to the results reported by Lin and Crawley (1987) in Taiwan and Asghar (1996) in Brunei. These researchers found that there were no significant gender differences in the students' perception of their science classroom environment. Furthermore, their findings showed

that there were no significant gender differences in the students' perception of any of the subscales of the classroom assessment instruments used in their studies.

Further *t*-test analysis of the data from this study was performed to compare the perception of the science laboratory environment for each of the Form Two classes according to gender. Tables 4.8 to 4.14 show the results of the analysis.

Table 4.8 shows that there is a significant difference between the mean overall SLEI score of the boys and the girls of Form 2 Jujur. The boys have a mean score of 120.35 with a standard deviation of 8.55, while the mean score and standard deviation for the girls are 127.06 and 10.30 respectively. The *t*-value of -2.19 is significant at $p < .05$.

Subsequent *t*-test analysis of the means obtained by the boys and girls for each of the SLEI subscales indicate that there were significant differences between the boys' and girls' perception for the subscales Student Cohesiveness, Integration, and Rule Clarity. The results show that the girls had a higher mean score than the boys for the perception of Student Cohesiveness, Integration, and Rule Clarity. This suggests that girls perceived the science laboratory more positively, (that the class was more cohesive, their laboratory activities were more integrated with the theory classes and that there were more formal rules to guide laboratory

activities) than the boys.

As can be seen from Table 4.8, the *t*-values for Open-endedness and Material Environment are not significant. The results suggest that the boys and girls of Form 2 Jujur had similar perceptions of Open-endedness and Material Environment.

However, *t*-test comparisons between the perceptions of the boys and the girls for the other six classes for each of the subscales and the overall perception show no significant differences at $p < .05$ except for the class of Form 2 Gigih. Table 4.11 shows that the mean score of Integration of the girls is 28.61 with a standard deviation of 5.07 while the boys have a mean score and standard deviation of 24.61 and 4.22 respectively. The *t*-value of -2.57 is significant at the $p < .05$.

The results of the *t* test analysis for each class indicate that boys and girls did not differ in their perception of the science laboratory environment except for Form 2 Jujur which was the best Form Two class among the eight classes. The results imply that for students who were academically most superior (Form 2 Jujur), the girls' perception on the science laboratory environment was significantly better than those of the boys.

Table 4.8

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Jujur.**

SLEI Subscale	Student Perceptions (N = 38)		*t*-test	
	Boys (N=20)	Girls (N=18)	*t*	*p*
Overall				
Mean	120.35	127.06	-2.19	sig.
Standard Deviation	8.55	10.30		$p < .05$
Student Cohesiveness				
Mean	27.25	30.11	-2.71	sig.
Standard Deviation	3.11	3.41		$p < .05$
Open-endedness				
Mean	17.10	17.17	-0.26	n.s.
Standard Deviation	2.53	4.15		
Integration				
Mean	29.15	31.50	-2.28	sig.
Standard Deviation	3.20	3.13		$p < .05$
Rule Clarity				
Mean	19.55	21.33	-2.65	sig.
Standard Deviation	2.09	2.06		$p < .05$
Material Environment				
Mean	27.30	26.94	0.27	n.s.
Standard Deviation	3.83	4.22		

n.s. denotes not significant at .05 level
N denotes number of students

Table 4.9

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Ikhlas.**

SLEI Subscale	Student Perceptions (N =35)		*t*-test	
	Boys (N=19)	Girls (N=16)	*t*	*p*
Overall				
Mean	116.68	117.94	-0.26	n.s.
Standard Deviation	13.26	15.07		
Student Cohesiveness				
Mean	26.89	27.63	-0.52	n.s.
Standard Deviation	4.36	3.83		
Open-endedness				
Mean	17.68	15.69	1.71	n.s.
Standard Deviation	3.22	3.68		
Integration				
Mean	26.05	27.44	-0.88	n.s.
Standard Deviation	4.17	5.14		
Rule Clarity				
Mean	19.53	20.31	-0.64	n.s.
Standard Deviation	3.88	3.30		
Material Environment				
Mean	26.53	26.88	-0.25	n.s.
Standard Deviation	3.53	4.87		

n.s. denotes not significant at .05 level
N denotes number of students

Table 4.10

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Setia.**

SLEI Subscale	Student Perceptions (N =34)		*t*-test	
	Boys (N=15)	Girls (N=19)	*t*	*p*
Overall				
Mean	114.13	119.21	-1.24	n.s.
Standard Deviation	11.28	12.29		
Student Cohesiveness				
Mean	25.07	25.68	-0.41	n.s.
Standard Deviation	4.83	3.96		
Open-endedness				
Mean	17.80	16.95	0.94	n.s.
Standard Deviation	2.65	2.61		
Integration				
Mean	26.47	28.58	-1.47	n.s.
Standard Deviation	3.78	4.45		
Rule Clarity				
Mean	18.33	19.89	-1.41	n.s.
Standard Deviation	3.52	2.92		
Material Environment				
Mean	26.47	28.11	-1.42	n.s.
Standard Deviation	3.31	3.35		

n.s. denotes not significant at .05 level
N denotes number of students

Table 4.11

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Gigih.**

SLEI Subscale	Student Perceptions (N =36)		*t*-test	
	Boys (N=18)	Girls (N=18)	*t*	*p*
Overall				
Mean	112.22	119.44	-1.69	n.s.
Standard Deviation	13.80	11.75		
Student Cohesiveness				
Mean	25.33	25.78	-0.31	n.s.
Standard Deviation	5.38	3.00		
Open-endedness				
Mean	17.44	16.78	0.57	n.s.
Standard Deviation	3.94	3.08		
Integration				
Mean	24.61	28.61	-2.57	sig.
Standard Deviation	4.22	5.07		$p<$ .05
Rule Clarity				
Mean	18.56	19.78	-1.29	n.s.
Standard Deviation	2.96	2.71		
Material Environment				
Mean	26.28	28.50	-1.63	n.s.
Standard Deviation	3.88	4.29		

n.s. denotes not significant at .05 level.
N denotes number of students

Table 4.12

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Tabah.**

SLEI Subscale	Student Perceptions (N =33)		*t*-test	
	Boys (N=19)	Girls (N=14)	*t*	*p*
Overall				
Mean	110.21	114.07	-1.10	n.s.
Standard Deviation	9.47	10.53		
Student Cohesiveness				
Mean	24.68	24.79	-0.08	n.s.
Standard Deviation	3.73	3.58		
Open-endedness				
Mean	17.57	16.28	1.36	n.s.
Standard Deviation	2.80	2.59		
Integration				
Mean	25.05	26.07	-0.87	n.s.
Standard Deviation	2.68	4.09		
Rule Clarity				
Mean	18.21	19.79	-1.88	n.s.
Standard Deviation	2.74	1.76		
Material Environment				
Mean	24.68	27.14	-1.95	n.s.
Standard Deviation	3.48	3.72		

n.s. denotes not significant at .05 level.
N denotes number of students

Table 4.13

t-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Tekun.

SLEI Subscale	Student Perceptions (N =30)		t-test	
	Boys (N=16)	Girls (N=14)	*t*	*p*
Overall				
Mean	109.25	111.29	-0.42	n.s.
Standard Deviation	12.57	13.76		
Student Cohesiveness				
Mean	25.13	26.00	-0.56	n.s.
Standard Deviation	3.36	5.07		
Open-endedness				
Mean	18.38	17.43	0.97	n.s.
Standard Deviation	2.68	2.62		
Integration				
Mean	24.13	24.00	0.10	n.s.
Standard Deviation	3.42	3.11		
Rule Clarity				
Mean	17.50	19.79	-1.05	n.s.
Standard Deviation	3.50	3.59		
Material Environment				
Mean	24.13	25.00	-0.43	n.s.
Standard Deviation	5.46	5.58		

n.s. denotes not significant at .05 level
N denotes number of students

Table 4.14

***t*-test Comparisons between Boys' and Girls' Perception of Science Laboratory Environment for Form 2 Usaha.**

SLEI Subscale	Student Perceptions (N =34)		*t*-test	
	Boys (N=21)	Girls (N=13)	*t*	*p*
Overall				
Mean	103.57	107.54	-0.85	n.s.
Standard Deviation	14.51	10.54		
Student Cohesiveness				
Mean	22.14	23.77	-0.96	n.s.
Standard Deviation	5.81	2.65		
Open-endedness				
Mean	16.14	16.15	0.01	n.s.
Standard Deviation	2.56	3.93		
Integration				
Mean	23.43	23.85	-0.34	n.s.
Standard Deviation	3.44	3.48		
Rule Clarity				
Mean	16.33	17.54	-0.86	n.s.
Standard Deviation	4.32	3.31		
Material Environment				
Mean	25.52	26.23	-0.38	n.s.
Standard Deviation	4.90	5.78		

n.s. denotes not significant at .05 level.
N denotes number of students