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# Assessing the Science Laboratory Learning Environments at the Senior Secondary Level in An Indian School

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**ABSTRACT**

Learning science can be made more interesting by providing the students hands on experience through experimentation and project work etc. This is especially true for science laboratories where students get a chance to test their ideas and learn difficult science concepts by performing experiments. Science laboratories have become a very important part of learning science in schools and thus students' perceptions of their science laboratory learning environments would provide valuable insights as to how science laboratories can be further improved and the right kind of environment is created that fosters learning. This study, which is the first of its kind in India, reports the use of the modified form of Science Laboratory Learning Environment Inventory (SLEI) for assessing the students' perceptions of their learning environments in General Science laboratories. Analysis of data of 460 students from higher secondary classes i.e. grades 10th to 12th provides evidence for the reliability and validity of the questionnaire for use in Indian school settings. The same data is also used for studying gender differences and the associations between students' perceptions of their science laboratory learning environments with their attitude towards science.

**Keywords:** Science Laboratory, Learning Environment, SLEI, Attitude, Indian School.

The next generation of youngsters, as it passes through school, must be as well educated in and about science to enable them to prosper in our democratic society. Moreover, the ever-increasing scientific and technological progress challenges man's ingenuity to improve his methods of processing, retrieving and reporting all sorts of scientific information. In a sense, we need a 'new breed' of people who can combine science with other talents, as for example, the scientist, librarian and the science reporter. Good science teaching is one of the most valuable ways to meet this urgent need for science-educated citizens and workers. Enthusiastic, intelligent, and well-educated science teachers inspire and prepare students to investigate the great questions of science and the questions raised by the scientific discoveries that affect us and our society. Mainly through the inspiration of devoted science teachers, great numbers of students develop lifelong scientific interests and learn to appreciate and understand the nature of science and its usefulness to mankind (Ediger and Rao, 1996).

I have been associated with the educational process at the school level for the last 16 years in Jammu which is part of the

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state of Jammu and Kashmir situated in the northern part of India, first as a science teacher at the secondary level and then as the principal of a higher secondary school during the course of which, I have observed the teaching styles and methodology used by various science teachers in the classroom and found that General Science (a combination of Physics, Chemistry and Biology) in schools is usually taught by a combination of lecture method, technology support and experimentation/ demonstration techniques. To attain the objectives of teaching science in a classroom, students need learning opportunities that capture and maintain learner attention and unless the students' interest is being maintained, the chances are that learning will not accrue, as it should. Hence it is important that the science teacher provides initiating experiences that engage the learner actively as it is important for students to attend to what is being presented for more optimal learning to occur (Ediger, 1997). One such experience in the teaching of science that enhances the scientific skills of the students is laboratory teaching or practical work, which is an essential component in developing the scientific bent of mind.

Science practical work can be used to help students achieve a number of learning outcomes, including: getting a feel for natural phenomenon, developing investigation skills and processes, providing a platform of experiences on which conceptual understanding can be built, giving students a sense of nature of science, and the excitement of inquiry and discovery. Practical work provides opportunities for students to develop learning outcomes that contribute to scientific literacy including the skills and understanding needed to conduct scientific investigations and to critically evaluate the claims made by others based on scientific evidence (Venville and Dawson, 2004).

As a researcher I have always been interested in the learning environments that exist in classrooms and other areas where the teaching-learning transaction takes place and thus science laboratories provide an interesting platform to study perceptions of students in such environments. The present study makes use of the modified form of Science Laboratory Learning Environment Inventory (SLEI) for assessing the students' perceptions of their learning environments in General Science (Physics, Chemistry and Biology) laboratories in an Indian school.

## OBJECTIVES OF THE STUDY

The main objectives of this study were: a) to establish the reliability and validity of the modified form of the Science Laboratory Environment Inventory (SLEI) (Fraser, Giddings and McRobbie, 1991) for use with urban Indian school students; b) to assess the students' perceptions of their Science Laboratory learning environment; c) to investigate associations of students' perception of their science laboratory learning environment with attitude towards science and d) to investigate whether gender differences occur in students' perception of their science laboratory learning environment.

## BACKGROUND OF THE STUDY

Research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes. However these measures cannot give a complete picture of the educational process. Because students spend up to 15,000 hours at school by the time they finish senior high school (Rutter, Maughan, Mortimore, Ouston, and Smith 1979), students have a large stake in what happens to them at school and their reactions to and perceptions of their school experiences are significant. Remarkable progress has been made in conceptualising, assessing and investigating the determinants and effects of social and psychological aspects of the learning environments of classrooms and schools. Not only has learning environments research expanded remarkably over the past few decades on the international scene, but also Asian researchers have made important and distinct contributions particularly over the previous decade. Asian researchers have cross-validated the main contemporary learning environment questionnaires that originated in the west and have undertaken careful translations and adaptations for use in the Chinese, Korean, Malay and Indonesian languages. Asian studies have successfully replicated Western research in establishing consistent associations between the learning environment and student outcomes, in using learning environment assessments in evaluation of education programmes and in identifying determinants of learning environments (Fraser, 2002).

Past research on learning environments provides numerous research traditions, conceptual models and research methods that are relevant to the present study. The present study draws on the rich resource of diverse, valid, economical and

widely applicable assessment instruments that are available in the field of science laboratory learning environments. Also, the study draws on past evaluations (Fraser, McRobbie and Giddings 1993; Fraser, Giddings and McRobbie, 1995; Waldrip and Giddings, 1993; Lee and Fraser, 2001) from the field of science laboratory learning environments.

## Development of the Science Laboratory Environment Inventory

Fraser, McRobbie, and Giddings (1993) developed a new instrument specifically suited to assessing the environment of science laboratory classes, the Science Laboratory Environment Inventory (SLEI). The SLEI has five scales and the responses for each item are in terms of Almost Never, Seldom, Sometimes, Often, and Very Often. The five scales that form a part of SLEI are Student Cohesiveness (SC), Open-Endedness (OE), Integration (IN), Rule Charity (RC), and Material Environment (ME). Since Fraser, McRobbie, and Giddings (1993) developed the SLEI by involving Australian secondary school students (Fraser, 1991) it has been extensively validated in a number of countries in different school settings such as the USA, Australia, Canada, England, Israel, Nigeria, Brunei, Singapore, South Korea, Thailand etc.(Fraser, Giddings and McRobbie, 1995; Fraser and McRobbie 1995; Wong and Fraser, 1996, Lee and Fraser, 2001; Quek, Fraser, and Wong, 2001). As a result, a Personal Form of the SLEI was developed and later applied to the other instruments in learning environment research (Lee and Fraser, 2001). Santiboon and Fisher (2005), using the SLEI (modified from the original SLEI) investigated the physics laboratory learning environments in upper secondary school in Thailand. A distinctive feature of most of the learning environment instruments including SLEI is that they have, not only a form to measure perceptions of actual or experienced classroom environment, but also a form to measure perceptions of ideal or preferred classroom environments. Students are made to understand that for the Actual Form they have to rate their classes as what they are actually like and for the Preferred Form what they would prefer or like it to be.

Table 1 shows the classification of each of the five scales of SLEI along with their description and the Attitude Towards Science scale taken from Test of Science Related Attitudes (TOSRA) (Fraser, 1981).

**Table 1. Names and Descriptions of the SLEI Scales and Attitude Towards Science Scale**

| Scale Name | Scale Description | Sample Item |
|---|---|---|
| Student Cohesiveness | The extent to which student know, help and are supportive of one another. | I am friendly with students in this laboratory class |
| Open Endedness | The extent to which the laboratory activities emphasize an open-ended divergent approach to experimentation. | I can pursue my own science interests in this laboratory class |
| Integration | The extent to which the laboratory activities are integrated with non-laboratory and theory classes. | My regular science class work is integrated with laboratory activities. |
| Rule Clarity | The extent to which the behaviour in the laboratory is guided by formal rules. | I am required to follow certain rules in the laboratory. |
| Material Environment | The extent to which the laboratory equipment and materials are adequate. | The laboratory equipment which I use is in proper working order. |
| Attitude Towards Science | The extent to which students are interested in, enjoy and look forward to lessons in science. | I look forward to lessons in this subject |

Responses of the items are scored 1, 2, 3, 4, and 5 respectively, from Almost Never, Seldom, Sometimes, Often to Almost Always. Missing or invalid responses are scored 3, the mid range value.

## DESIGN AND PROCEDURE

A quantitative research methodology was adopted for this study. The school chosen for this study was a 74 year old institute in Jammu (J&K State, India), which has over the years developed modern academic infrastructure and thus provided

the right atmosphere to study the learning environments of a science laboratory and assess students' attitude towards science. The sample for the study was chosen carefully so as to be representative of the population and comprised of coeducational classes in order to permit an unbiased test of gender differences. The sample involved 460 students in 9 science classes from grades 10 to 12 who had the experience of working in a science laboratory. In the whole group there were 270 (58.69%) male students and 190 (41.30%) female students. The study was carried out in two stages. In the first stage the modified Science Laboratory Learning Environment Inventory (SLEI) was field tested with a sample of 50 students from grades 10 to 12 to ensure that the students comprehended the questionnaire. An examination of the responses given by the students revealed that some of the items had not been properly understood. These items were modified so that the students could understand them and respond in the right manner. In the second stage, the modified SLEI was administered to assess perceptions that students have of their science laboratory learning environments and the attitudes towards science were measured with a scale based on an adaptation of the Test of Science Related Attitudes (TOSRA) (Fraser, 1981). The data thus collected was tabulated in an excel file and statistically analysed using SPSS.

## RESULTS AND DISCUSSION

### Validation of the SLEI

The data for the modified SLEI were collected from a sample of 460 students in 9 science laboratory classes and were analysed to determine the reliability and validity of the SLEI for use in Indian school settings. Three indices for scale reliability and validity were generated for both the Actual and Preferred Forms separately. The Cronbach alpha reliability coefficient was used as an index of scale internal consistency indicating the consistency of the test items relative to other test items, which are designed to measure the same construct of interest. Analysis of variance (ANOVA) results were used as evidence of the ability of each scale in the Actual Form to differentiate between the perceptions of students in different classrooms. A discriminant validity index (namely, the mean correlation of a scale with other scales) was used as evidence that each SLEI scale measures a separate dimension that is distinct from the other scales in this questionnaire.

The results of the three statistical indices are reported in Table 2. The scale reliability estimates for the different scales of the Actual form of SLEI using the individual student as the unit of analysis ranged from 0.52 for the Student Cohesiveness and Rule Clarity scale to 0.66 for the Material Environment scale in the Actual Form. These indices of reliability are comparable to those in past studies that have used the SLEI (Fraser, Giddings and McRobbie, 1991,1993; Wong and Fraser, 1995; Lee and Fraser, 2001; Henderson, Fisher and Fraser, 2000). However, for the scale of Student Cohesiveness, Open Endedness and Rule Clarity the alpha reliability coefficient reported scores of 0.48, 0.50 and 0.38 which when recomputed after deleting of an item changed to 0.52, 0.60 and 0.52 respectively. The item deleted for computation purposes was number six, i.e., 'It takes me a long time to get to know everybody by his/her first name in this laboratory class' from the Student Cohesiveness scale, item six, i.e. 'The teacher decides the best way for me to carry out the laboratory experiments' from the Open Ended scale and item five, i.e., 'There are few fixed rules for me to follow in laboratory class' from the Rule Clarity scale. These items were then deleted in the application of the SLEI in the research study. The reliability results of SLEI were consistently above 0.50. This suggested that the Actual Form of SLEI could be considered a reliable tool (De Vellis, 1991) with Indian school student.

**Table 2. Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Classrooms (ANOVA Results) for the Actual Form of Modified SLEI**

| Scale Name | No. of Items | Alpha Reliability | | Validity Mean | ANOVA *eta*$^2$ |
|---|---|---|---|---|---|
| | | Bef. | Aft. | | |
| Student Cohesiveness | 7 | 0.48 | 0.52 | 0.21 | 0.013* |
| Open Endedness | 7 | 0.50 | 0.60 | 0.07 | 0.010* |
| Integration | 7 | | 0.63 | 0.22 | 0.005 |
| Rule Clarity | 7 | 0.38 | 0.52 | 0.27 | 0.011 |
| Material Environment | 7 | | 0.66 | 0.24 | 0.005 |

* Significant at $p<0.05$ n = 460

Bef. Means Before and Aft. means After deleting an item.

The *eta*$^2$ statistics (which is the ratio of 'between' to 'total' sum of squares) represents the proportion of variance explained by class membership.

Using the individual as the unit of analysis, the discriminant validity results (mean correlation of a scale with other scales) for the nine scales of the TROFLEI ranged from 0.07 for the Open Endedness scale to 0.27 for the Rule Clarity scale in the Actual form (Table 2). The analysis of variance (ANOVA) was used to determine the ability of the actual version of each SLEI scale to differentiate between the perceptions of students in different classes. The one-way ANOVA for each scale involved class membership as the independent variable and the individual student as the unit of analysis. Table 2 reports the ANOVA results showing that two of the five scales of SLEI differentiate significantly between classes ($p<0.05$). Thus, students within the same class perceive the environment in a relatively similar manner, while the within-class mean perceptions of the students vary between classes. The $eta^2$ statistic (an estimate of the strength of association between class membership and the dependent variable) ranges from 0.005 for the Material Environment scale and Integration scale to 0.013 for the Student Cohesiveness scale in the Actual Form of the SLEI.

Similarly, the scale reliability estimates for the different scales of the Preferred Form of SLEI using the individual student as the unit of analysis ranged from 0.53 for the Open Endedness and Rule Clarity scale to 0.61 for the Student Cohesiveness scale in the Preferred Form (Table 3). However, for the scale of Open Endedness and Rule Clarity the alpha reliability coefficient reported scores of 0.45 and 0.40 which when recomputed after deleting of an item changed to 0.53 for both the scales respectively. The item deleted for computation purposes was number one, i.e., 'I would like to pursue my own science interests in this laboratory class' from the Open Endedness scale and item five, i.e. 'There would be few fixed rules for me to follow in laboratory class' from the Rule Clarity scale. These items were then deleted in the application of the SLEI in the research study. The reliability results of the SLEI were consistently above 0.50. This suggested that the Preferred Form of SLEI could be considered a reliable tool (De Vellis, 1991) with Indian school student.

Using the individual as the unit of analysis, the discriminant validity results (mean correlation of a scale with other scales) for the nine scales of the Preferred Form of SLEI ranged from 0.03 for the Open Endedness scale to 0.34 for the Rule Clarity and Material Environment scale in the Preferred form (Table 3).

**Table 3. Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Classrooms (ANOVA Results) for the Preferred Form of Modified SLEI**

| Scale Name | No. of Items | Alpha Reliability | | Validity Mean | ANOVA *eta*$^2$ |
|---|---|---|---|---|---|
| | | Bef. | Aft. | | |
| Student Cohesiveness | 7 | | 0.61 | 0.33 | 0.009 |
| Open Endedness | 7 | 0.45 | 0.53 | 0.03 | 0.004 |
| Integration | 7 | | 0.60 | 0.26 | 0.012 |
| Rule Clarity | 7 | 0.40 | 0.53 | 0.34 | 0.032** |
| Material Environment | 7 | | 0.72 | 0.34 | 0.028** |

** Significant at $p<0.001$ n = 460

Bef. Means Before and Aft. means After deleting an item.

The *eta*$^2$ statistics (which is the ratio of 'between' to 'total' sum of squares) represents the proportion of variance explained by class membership.

The analysis of variance (ANOVA) was used to determine the ability of the actual version of each SLEI scale to differentiate between the perceptions of students in different classes. The one-way ANOVA for each scale involved class membership as the independent variable and the individual student as the unit of analysis. Table 3 reports the ANOVA results showing that two of the five scales of SLEI differentiate significantly between classes ($p<0.05$). Thus, students within the same class perceive the environment in a relatively similar manner, while the within-class mean perceptions of the students vary between classes. The $eta^2$ statistic (an estimate of the strength of association between class membership and the dependent variable) ranges from 0.004 for the Open Endedness scale to 0.032 for the Rule Clarity scale in the preferred Form of the SLEI.

## Means and Standard Deviation on the SLEI

Item means and standard deviations were computed to determine the nature of science laboratory learning environments using the SLEI. The statistical significance of the difference between means (t-test) was also calculated to study whether the differences in the means of the Actual and Preferred Forms of the SLEI when used in Indian classroom settings were significant. The data obtained are presented in Table 4.

From results in Table 4 it can be seen that the mean scores of the different scales of the SLEI ranged from 2.60 for the Open Endedness scale to 3.72 for the Student Cohesiveness scale in the Actual Form which shows that students were generally able to perceive cohesion between them and are helpful and supportive of each other in the laboratory class. If the mean scores in the Preferred Form of SLEI are examined, it can be seen that they ranged from 2.87 for the Open Endedness scale to 3.74 for the Student Cohesiveness scale. This again reiterates the fact that students usually want more of support, help and cooperation from their friends in their future laboratory classes. The values of the standard deviations in both the Actual and Preferred Form of the SLEI are less than 1, which suggests that there are no major deviations in students' perceptions of their science laboratory learning environments.

The results for the t-tests on paired samples indicated that there is a significant difference ($p<0.001$) between the actual and preferred means for all the scales (Table 4). This shows that students' preferred learning environments should have more student cohesiveness, more open endedness in terms of decision

**Table 4. Mean, Standard Deviation (SD) and Significance of Difference between Means (t) for the Modified SLEI.**

| Scale Name | No. of Items | Mean | | Standard Deviation (SD) | | *t* |
|---|---|---|---|---|---|---|
| | | Act. | Pref. | Act. | Pref. | |
| Student Cohesiveness | 7 | 3.72 | 3.74 | 0.53 | 0.57 | 0.50* |
| Open Endedness | 7 | 2.60 | 2.87 | 0.63 | 0.48 | 9.05** |
| Integration | 7 | 3.41 | 3.66 | 0.70 | 0.69 | 7.05** |
| Rule Clarity | 7 | 3.54 | 3.65 | 0.54 | 0.57 | 3.67** |
| Material Environment | 7 | 3.51 | 3.95 | 0.75 | 0.79 | 10.32** |

** Significant at $p<0.001$
n = 460

making on part of the students, a greater integration between what is being taught in the classroom and the practical work being done in the laboratory, need further clarity with respect to rules and regulations for working in the laboratory and seek better material support to perform the laboratory experiments in terms of equipment, chemicals etc. Although, all the scales of the SLEI show a good response from the students, the main

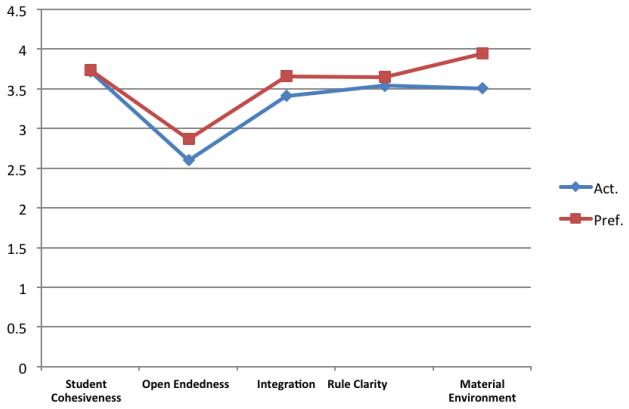


**Figure 1.** Mean scores of the Actual and Preferred Forms of the SLEI.

objective is to improve the existing learning environments in the science laboratory and the information from the students' perceptions of their preferred learning environments gives us vital clues towards the areas that require our immediate focus for further improvement. Figure 1 represents the mean scores on the Actual and Preferred Forms of SLEI in a graphical form.

## Validation, Mean and Standard Deviation of the Attitude Towards Science Scale

To measure students' attitude towards the subject, data was collected on the Attitude Towards Science scale. There were eight items in this scale. The data on this scale was also collected from a sample of 460 students in 9 classes. The internal consistency reliability (Cronbach alpha coefficient) was computed with the individual as the unit of analysis along with its mean and standard deviation. The results have been shown in Table 5.

**Table 5. Internal Consistency Reliability (Cronbach Alpha Coefficient), Mean and Standard Deviation for the Attitude Towards Science scale.**

| Scale Name | No. of Items | Alpha Reliability | Mean | Standard Deviation |
|---|---|---|---|---|
| Attitude Towards Science | 8 | 0.68 | 3.85 | 0.62 |

n=460

The scale reliability for the Attitude Towards Science scale is 0.68. The reliability result of this scale was consistently above 0.50. This suggested that this scale could be used as a reliable

tool (De Vellis, 1991) in Indian science laboratory settings to study the attitude of students. The value of the mean for the Attitude Towards Science is 3.85 (see Table 6). The high mean score points towards the fact that generally students exhibit a positive attitude towards science when taught in a laboratory based learning environment.

## Investigation of the Association between the SLEI Scales and Attitude Towards Science Scale.

Students' perception of their science laboratory learning environment and its association with their attitude towards science were explored using simple and multiple correlation analysis, followed by computation of the regression coefficient. The results of these analyses are shown in Table 6, which gives a clear picture indicating significant associations between science laboratory learning environments and student outcomes. The results from Table 6 indicate that for simple correlations ($r$) four out of five scales of SLEI are statistically significantly and positively associated with student attitudes towards science ($p<0.01$, $p<0.001$) at the individual level of analysis. The values of correlation range from 0.00 for the Open Endedness scale to 0.36 for the Rule Clarity scale.

**Table 6. Association between SLEI Scales and Attitude Towards Science in terms of Simple Correlations (r), Multiple Correlation (R) and Standardised Regression Coefficient (β).**

| Scale Name | Attitude Towards Science | |
|---|---|---|
| | $r$ | $\beta$ |
| Student Cohesiveness | 0.35** | 0.24*** |
| Open Endedness | 0.00 | -0.04 |
| Integration | 0.28** | 0.15** |
| Rule Clarity | 0.36** | 0.20*** |
| Material Environment | 0.24** | 0.07* |

Multiple Correlation R = 0.47***

$R^2$ = 0.22

*** Significant at p<0.001 ** Significant at p<0.01 * Significant at p<0.05

The multiple correlation value ($R$) between students' perceptions as measured by the different scales of the SLEI and the Attitude Toward Science scale (see Table 6) is 0.47 at the individual level of analysis, which is statistically significant ($p<0.001$). The $R^2$ value indicates that 22 percent of the variance in the students' attitude towards science can be attributed to the science laboratory learning environment and thus the better the learning environment the more positive are the students' attitudes towards science. Standardized regression values were calculated to provide information about the unique contribution of each learning environment scale to the Attitude Towards Science scale. Regression coefficient values ($\beta$) indicate (see Table 6) that four of the five SLEI scales uniquely account for a significant ($p<0.001$, $p<0.01$, $p<0.05$) amount of variance in student attitudes towards science; these are Student Cohesiveness, Integration, Rule Clarity and Material Environment. The $\beta$ values for the significantly associated scales ranged from 0.07 for the Material Environment scale to 0.24 for the Student Cohesiveness scale. From the point of view of this study, it is pertinent to note that majority of the scales of the SLEI are positively associated with the attitude scale and thus it may be interpreted that laboratory work helps in developing positive attitude towards science, which in fact is one of the aims of this study.

**Table 7. Significance of Difference between Means for Gender Differences as Measured by the Modified SLEI and the Attitude Towards Science Scale.**

| Scale | Gender | Mean | Standard Deviation | t |
|---|---|---|---|---|
| Student Cohesiveness | Males | 3.68 | 0.53 | 1.82 |
| | Females | 3.77 | 0.53 | |
| | | | | |
| Open Endedness | Males | 2.64 | 0.62 | 1.87 |
| | Females | 2.53 | 0.64 | |
| | | | | |
| Integration | Males | 3.33 | 0.70 | 2.90** |
| | Females | 3.52 | 0.68 | |
| | | | | |
| Rule Clarity | Males | 3.44 | 0.51 | 4.57*** |
| | Females | 3.68 | 0.55 | |
| | | | | |
| Material | Males | 3.46 | 0.72 | 1.54 |
| Environment | Females | 3.57 | 0.77 | |
| | | | | |
| Attitude | Males | 3.71 | 0.61 | 5.44*** |
| | Females | 4.03 | 0.59 | |
| | | | | |

### Investigation of Gender Differences

The association between gender differences and technology-supported learning environments was studied by first dividing the main group of students into two subgroups of male and female. Means and standard deviations for the two groups were computed followed by a test of significance of difference between means (*t*-test for independent samples), to find out gender difference on the five scales of SLEI and the Attitude Towards Science scale. The data obtained statistically has been illustrated in Table 7. From the information given in the table, it can be seen that out of the five scales of the SLEI only two scales, i.e. Integration with a *t* value of 2.90 and Rule Clarity with a *t* value of 4.57 are statistically significant ($p<0.01$ and $p<0.001$). In the two scales, which are statistically significant, females have a higher mean score than males. This means that female students demonstrate more of knowledge integration as compared to male students and they may be applying their theoretical knowledge in completing or performing their laboratory work. Similarly, female students also tend to exhibit better rule clarity while working in science laboratories as compared to male students. Such differentiation is also visible in favour of female students when we see the data pertaining to Attitude Towards Science scale; as females tend to have a higher mean value than male students. This may show that they have a more positive attitude towards science in relation to working in science laboratories.

## CONCLUSION

The present study contributed towards establishing the reliability and validity of the Science Laboratory Environment Inventory (SLEI) that was used to assess students' perceptions of their science laboratory learning environments in an Indian classroom situation for the first time. Further investigation suggested that positive associations existed between students' perceptions of their laboratory learning environments and their attitude towards science. Gender differences in favour of female students were also reported on two scales of the SLEI and the Attitude Towards Science scale. The main aim of practical work is to provide opportunities for the development of aspects of scientific literacy, an understanding of the nature of science and in particular an understanding of scientific evidence and the development of critical thinking skills (Venville and Dawson, 2004), the knowledge of learning environments of science laboratories will helping in furthering these objectives. The teachers will get vital clues by understanding the students' perceptions as to how to create the right kind of environment that fosters learning and help nurture a scientific bent of mind by inculcating the right values and skills required for laboratory work. This research study also provides information to the science teachers and practitioners of science education especially in Indian schools that students need to be given a certain amount of freedom in their laboratory work so that they can test their own ideas, apply divergent thinking, design their own experiments and go beyond the limits of the curriculum.

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