Measuring Students’ Learning Attitudes about Science in Diploma Engineering Institutes (Polytechnics) of Sikkim using CLASS

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Abstract

Science education researchers have studied students' preconceptions about science and learning science and have provided a measure as to how these views change over time with relation to their reception to classroom instruction in science. Myriads of instruments have been deliberated to examine the students' changing attitudes, beliefs and expectations. Deploying the Colorado Learning Attitudes about Science Survey (CLASS) – we report results from survey of 233 students studying in 1st Year at Centre for Computers and Communication Technology (CCCT) and Advanced Technical Training Centre (ATTC) located at South and East Districts of Sikkim respectively.

Keywords: Beliefs, Attitude, CLASS, Science Education, Learning Physics

I. INTRODUCTION

Science is progressing faster today than ever before and learning of Science has become paramount. Also, learning Science has proven to complement in the learning of other subjects such as History, Geography, Mathematics, English, etc. It has now become imperative, more than ever, that teachers try and make learning of Science an enjoyable experience, one that the students remember for a lifetime. As learning Science is an on-going process and continues even after these students have stepped out of school, it becomes important to investigate the same as these students are the flag bearing citizens of tomorrow.

Upon a closer chronological inspection, one of the notable contribution towards propagating the learning of Science was made by Klopf er [1971], who classified a set of effective approaches in Science education as:

– The manifestation of favourable attitudes towards Science and scientists;
– The acceptance of scientific enquiry as a way of thought;
– The adoption of ‘scientific attitudes’;
– The enjoyment of Science learning experiences;
– The development of interests in Science and Science-related activities; and
– The development of an interest in pursuing a career in Science or Science related work.

II. LITERATURE REVIEW

It is therefore in the interest of the society, and the responsibility of educators, to improve students' attitude towards Science, and to prepare students to live in a highly scientific and technological society. The future of our society will be determined by citizens who are able to understand and help shape the complex influences of Science and technology on our world [Ungar, 2010].

A study was conducted by Ali and Awan [2013] to examine the relationship of attitude of secondary school students towards Science with the achievement in the subjects of Physics, Chemistry, Biology and Mathematics. TOSRA was used as a significant instrument in this study to provide a determinate measure of students’ attitude towards Science. Data was collected from a sample of 1,885 students of 10th grade. The results of the study indicated that attitude towards Science had significantly positive relationship with the achievement of Science students at secondary level.

Students' belief studies have gained considerable interest, in recent years, in physics education research. W. K. Adams et al [2006]; E. F. Redish et al [1998]; I. A. Halloun et al [1996] and A. Elby et al [1998] have shown that students’ attitudes, expectations, views, and beliefs play important roles in learning and distinguish experts in a field from novices.
D. Hammer et al [2000]; E. F. Redish et al [2003] and W.K. Adams et al [2006] have examined how various populations of undergraduate students assess physics as they take it up as a subject in their first course in college and how they change their attitude and beliefs afterwards. Such studies are important as research has shown that key educational outcomes, such as curiosity in science and science learning correlate with students’ beliefs and attitudes.

At the crux of our science education endeavor, is the desire to nurture scientific curiosity and capacity in our students, preparing them as both future scientists and responsible citizens.

A. CLASS

The Colorado Learning Attitudes about Science Survey (CLASS) is an instrument that has been developed and validated at the University of Colorado, Boulder (CU) over the past several years. It consists of forty-two statements that cover various categories such as Personal Interest (PI), Real World Connection (RWC), Problem Solving General (PS(G)), PS Confidence (PS(C)), PS Sophistication (PS(S)), Sense Making / Effort (SM), Conceptual Understanding (CU), Applied Conceptual Understanding (ACU).

Table – 1
Colorado Learning Attitudes about Science Survey

<table>
<thead>
<tr>
<th></th>
<th>PI</th>
<th>RWC</th>
<th>PS(G)</th>
<th>PS(C)</th>
<th>PS(S)</th>
<th>SM</th>
<th>CU</th>
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</table>

The numbers indicate the question numbers in the survey.

The Colorado Learning Attitudes about Science Survey (CLASS) was devised to measure student beliefs at the start (pre) and end (post) of several introductory physics courses. The CLASS survey constructs on the existing attitude surveys (MPEX, VASS, EBABS). The details of the design and validation of the CLASS are reported by Adams et al.

Several design principles shaped the CLASS and distinguish it from the previous surveys:
- It was designed to address a wider variety of issues that educators consider important aspects of learning physics.
- The wording of each statement was carefully constructed and tested to be clear and concise and subject to only a single interpretation by both a broad population of students and a range of experts.
- The statements were written to be meaningful even to students who had never taken physics.
- The “expert” and “novice” responses to each statement were unambiguous so scoring of the responses was simple and obvious.
- The amount of time required to thoughtfully complete the survey was kept to 10 minutes or less by requiring clear and concise statements and using a simple response format.
- The administration and scoring was designed to be easy.
- The grouping of statements into categories of student beliefs was subject to rigorous statistical analysis and only statistically robust categories were accepted. The resulting categories characterize identifiable and useful aspects of student thinking.

III. SCORING

Scoring is done by determining the percentage of responses for each student upon which the student agrees with the experts’ view (‘percent favorable’) and then averaging these individual scores to determine the average percent favorable. The survey consists of 42 statements to which students respond using a 5-point Likert scale.

IV. OBJECTIVES OF THE STUDY

The following are the objectives of this study:
- To find out if there is any difference in Learning Attitudes about Physics between male and female students.
- To know if there is any difference in Learning Attitudes about Physics between students studying in urban and rural areas.
- To know if there is any difference in Learning Attitudes about Physics between students passing 10th grade from Govt. or Private Institutions.

V. HYPOTHESES

- H1: There is significant difference in Learning Attitudes about Physics between male and female students.
- H2: There is significant difference in Learning Attitudes about Physics between students studying in urban and rural areas.
- H3: There is significant difference in Learning Attitudes about Physics between students who have passed 10th grade from Govt. or Private Institutions.
VI. DELIMITATION OF THE STUDY

- The study is limited to 1st Year students of the two Polytechnics (CCCT and ATTC) in Sikkim.
- The physics teachers are not included in this study.

VII. METHODOLOGY OF THE STUDY

A. Tools Used

The tool used for this survey was the Colorado Learning Attitudes about Science Survey (CLASS). It is an instrument developed and validated at the University of Colorado, Boulder (CU). It consists of forty two statements that cover various categories, such as real world connection, problem solving and conceptual understanding.

B. Samples

In the present study, to measure Students’ Learning Attitudes about Science in Diploma Engineering Institutes (Polytechnics) of Sikkim using CLASS, the sample consisted of all the 233 students studying in 1st Year Diploma Engineering Courses in the two Polytechnics in Sikkim viz. Centre for Computers and Communication Technology (CCCT) and Advanced Technical Training Centre (ATTC) located at South and East Districts of Sikkim respectively.

C. Area of the Study

The present study was conducted among the students studying in 1st Year at Centre for Computers and Communication Technology (CCCT) and Advanced Technical Training Centre (ATTC) located at South and East Districts of Sikkim. The Institutes conduct AICTE approved Three year diploma engineering courses and are ISO 9001:2008 certified. The Institutes are managed as autonomous Institutes under the Directorate of Technical Education, Human Resource Development Department, and Government of Sikkim.

D. Administration of CLASS and Collection of Data

The CLASS test was administered to 233 number of students studying in 1st Year Diploma Engineering Courses in the two Polytechnics in Sikkim. The investigators went to the above said institutions, took permission from the Head of the institution for administering the CLASS.

VIII. ANALYSIS AND INTERPRETATION

A. Analysis of data relating to Hypothesis no.1

H1: There is significant difference in Learning Attitudes about Physics between male and female students.

1) P value and statistical significance

The two-tailed P value equals 0.7504. By conventional criteria, this difference is considered to be not statistically significant.

2) Confidence interval

The mean of Female students minus Male students equals 0.03005680379 with 95% confidence interval of this difference: From -0.15726650318 to 0.21738011075

3) Intermediate values used in calculations

t = 0.3192; df = 82; standard error of difference = 0.094

<table>
<thead>
<tr>
<th>Group</th>
<th>Female</th>
<th>Male</th>
</tr>
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<tbody>
<tr>
<td>Mean</td>
<td>3.40584415576</td>
<td>3.37578735198</td>
</tr>
<tr>
<td>SD</td>
<td>0.45847996239</td>
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<tr>
<td>SEM</td>
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</tbody>
</table>

B. Analysis of data relating to Hypothesis no.2

H2: There is significant difference in Learning Attitudes about Physics between students studying in urban and rural areas.

1) P value and statistical significance

The two-tailed P value equals 0.6993. By conventional criteria, this difference is considered to be not statistically significant.

2) Confidence interval

The mean of Rural areas minus Urban areas equals -0.03465716160 with 95% confidence interval of this difference: From -0.21253069648 to 0.14321637329
3) Intermediate values used in calculations

\[ t = 0.3876; \text{df} = 82; \text{standard error of difference} = 0.089 \]

<table>
<thead>
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C. Analysis of data relating to Hypothesis no.3

H3: There is significant difference in Learning Attitudes about Physics between students who have passed 10th grade from Govt. and Private Institutions.

1) P value and statistical significance

The two-tailed P value equals 0.8538. By conventional criteria, this difference is considered to be not statistically significant.

2) Confidence interval

The mean of Govt. Schools minus Private Schools equals \(-0.01671930374\) with 95% confidence interval of this difference: From \(-0.19660346770\) to \(0.16316486022\)

3) Intermediate values used in calculations

\[ t = 0.1849; \text{df} = 82; \text{standard error of difference} = 0.090 \]

<table>
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<tr>
<th>Group</th>
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IX. Conclusion

1) There is no significant difference in Learning Attitudes about Physics between male and female students.
2) There is no significant difference in Learning Attitudes about Physics between students studying in urban and rural.
3) There is significant difference in Learning Attitudes about Physics between students who have passed 10th grade from Govt. or Private Institutions.

References

[14] A copy of the CLASS can be found at http://CLASS.colorado.edu