Scientific Attitude In Relation To Critical Thinking among Teachers

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Abstract
Scientific attitude helps to tackle problem objectively without bias promoting logical thinking. It is the “scientific spirit” or “scienticism” which creates rational outlook. A person accepts whatever is based on scientific background. Scientific approach is progressive, such a person is never too certain of his facts and ready to accept truth on the basis of empirical data, encourages systematic doubts and critical thinking. Critical thinking is self-guided, self-disciplined thinking which attempts to reason at the highest level of quality in a fair-minded way. He works diligently to develop the intellectual virtues of intellectual integrity, intellectual humility, intellectual civility, intellectual empathy, intellectual sense of justice and confidence in reason. He avoids thinking simplistically about complicated issues and strives to appropriately consider the rights and needs of relevant others. The study had been conducted on teachers of Mohali district of Punjab through descriptive research. Findings revealed that there had been significant difference among the male and female teachers on scientific attitude and critical thinking favoring the female teachers; signifying more scientific attitude and critical thinking than their male counterparts. Both the variables signified positive co-relation meaning that there is strong co-relation between two variables signifying the dependency of one on the other.

Keywords: Attitude, Critical thinking, Scientific Attitude

Introduction
Education is a field where knowledge panes through all walk of life from person to person with varying degrees. It helps an individual to move towards the goal set and it may be said that people reach their goal following clearly defined paths. Scientific attitude refers to critical observation, inquisitiveness, broadmindedness and open mindedness. The teachers having critical thinking disposed to care that their beliefs be true and that their decisions be justified; that is, care to "get it right" to the extent possible.

Science
Science has derived from latin word “scientia” which means knowledge. Science is a systemized body of knowledge. This knowledge may pertain to any subject or field of life. Science strengthens the commitment of man to free enquiry and to the quest for truth as his highest duty and obligation. It loosens the bonds of dogmatism and acts as a powerful dispeller of fear and superstition, fatalism and passive resignation. By its emphasis on reason and free enquiry, it even helps to lessen ideological tensions; which often arise because of adherence to dogma and fanaticism (Report of the Education commission, 1966).
Attitude

A mental or neural state of readiness, organized through experience, exerting a directive dynamic influence upon the individual’s response to all objects and situations with which it is related. Our attitudes are based on information. Our lives are filled with opportunities for attitude change. They are based on belief and often have import for guiding behavior. An attitude can be defined as an enduring organization of motivational, emotional, perceptual, and cognitive processes with respect to some aspect of the individual's world (Krech & Crutchfield, 1948). Attitude as a psychological tendency: that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly & Chaiken, 1993).

Scientific Attitude

Scientific Attitudes are the most important outcomes of science teaching. The development of scientific attitudes should not be left to chance. The science teacher should make a special effort to develop them. Some characteristics of scientific attitude in an individual are open mindedness, curiosity, judgement based on verified facts, ready to test and verify conclusion, faith in cause and effect relationship, be ready to reconsider his judgement, be free from superstitions and false beliefs, honest in recording, collecting and reporting scientific data, being critical in observations, accepting no conclusions a final or ultimate and more faith in the books written by specialists in their respective fields etc.

Scientific attitude includes the following habits of thinking, viz. habit of accuracy in all operations, including accuracy in calculation, observation and report; habit of intellectual honesty; habit of open mindedness; habit of suspended judgement; habit of looking for true causes and effect relationship and habit of criticalness, including that of self-criticism (Noll, 1935). Scientific attitude is a curiosity to know about one’s environment; the belief that nothing can happen without a cause and those occurrences that seem strange and mysterious can always be explained by natural causes (Caldwell & Curtis, 1943).

Scientific attitude is the possession of the skills and attitudes necessary for the usage of the scientific process and the possession of the knowledge acquired through the process that make a person a scientist (Opong, 1981). Through science teaching certain social ethics and values such as honesty, rationality, objectivity and making judgement on the basis of reliable information can be developed in our youths. He listed open-mindedness, curiosity and an optimistic approach to failure as values that are closely related to scientific training. These attitudes are very important for all citizens (Abdullahi, 1982). Scientific attitude is the combination of many qualities and virtues, which is reflected through the behavior and action of the person. These persons are open-minded, experiment oriented, systematic in approach, possess love for knowledge, intellectually honest, unbiased, truthful, and possess scientific temper’ and the expectations that the solution of the problem will come through the use of verified knowledge (Jancirani, Dhevakrishnan & Devi, 2012).

Critical Thinking

Critical thinking includes the ability to respond to material by distinguishing between facts and opinions or personal feelings, judgments and inferences, inductive and deductive arguments, and the objective and subjective. It also includes the ability to generate questions, construct, and recognize the structure of arguments, and adequately support arguments; define, analyze, and devise solutions for problems and issues; sort, organize, classify, correlate, and analyze materials and data; integrate information and see relationships; evaluate information, materials, and data by drawing inferences, arriving at reasonable and informed conclusions, applying understanding and knowledge to new and different problems, developing rational and reasonable interpretations, suspending beliefs and remaining open to new information, methods, cultural systems, values and beliefs and by assimilating
information. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

Critical thinking is a process that begins with an argument and progresses toward evaluation (Browne & Keeley, 2000). Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed (Halpern, 2003). Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking. It requires rigorous standards of excellence and mindful command of their use. It entails effective communication and problem solving abilities and a commitment to overcoming our native egocentrism and socio-centrism (Paul & Elder, 2008).

Statement of The Problem
SCIENTIFIC ATTITUDE IN RELATION TO CRITICAL THINKING AMONG SCHOOL TEACHERS

Rationale
We need to have willingness to give up an old established theory and identify new ideas without being misled by hindsight bias and overconfidence. There would be no branch of new knowledge discovered without this scientific attitude. Critical thinking is a process of analyzing arguments and conclusions. It is a process of examining the offered evidence and reasoning, and forming reasonable judgments about the facts. Without the critical thinking ability, we would be misled to our high sight bias and overconfidence of our judgments. Science education often includes in its aims the development of critical-mindedness. This is usually regarded as one of a range of scientific attitudes. It is argued that critical-mindedness depends on appropriate cognitive and affective inputs as well as critical thinking ability, and that consequently critical-mindedness is context dependent.

Design of the Study
For the present study Descriptive survey method had been used.

Objectives
1. To study scientific attitude among teachers.
2. To study critical thinking among teachers.
3. To study the relationship of scientific attitude and critical thinking among teachers.

Hypotheses
1. There exists no significant difference of scientific attitude among male and female teachers.
2. There exists no significant difference of critical thinking among male and female teachers.
3. There exists no relationship of scientific attitude and critical thinking among teachers.

Delimitations
1. The present study had been restricted to teachers of primary schools.
2. The study had been restricted to Government Primary Schools of Mohali district.

Sample of the Study
To collect the data a sample of 100 teachers belonging to government primary schools of Mohali District had been taken. Teachers consisting of two groups i.e. male and female, 50 male and 50 female. Convenient method of sampling has been used.
Tools Used
The tools employed in the present study are:
(i) Scientific Attitude Scale by Bhagawat (2006).
(ii) Critical Thinking Test (2012) prepared by the researchers.

Statistical Techniques Used
Mean, Median, Mode, Standard Deviation, t-test and correlation (Pearson’s coefficient of correlation).

Analysis and Interpretation
Analysis means categorization, ordering and summarizing of data to obtain answer to research questions. The purpose of analysis is to produce data to intelligible and interpretable form, so that the relation of the research problems can be studied and tested.

OBJECTIVE: TO STUDY SCIENTIFIC ATTITUDE AMONG MALE AND FEMALE TEACHERS
H$_{10}$: There exists no significant difference of Scientific Attitude among male and female teachers.

| Table I t – test Analysis of Scientific Attitude Scores among Male & Female Teachers |
|---------------------------------|---|---|---|---|
| Gender           | N  | Mean  | Std. Dev. | t-value |
| Female          | 50 | 84.68   | 10.499     | 2.944*  |
| Male            | 50 | 79.08   | 8.408       |         |

*significant at .01 level

Table I shows standard deviation is 10.499 for female teachers and 8.408 for male teachers, t-value is 2.944 which is significant at 0.01 level. It states that there is a significant difference between the male and female teachers. So the null hypothesis H$_{10}$: “There exists no significant difference of scientific attitude among male and female teachers” has not been accepted; which means there is difference between the scientific attitude of male and female teachers. As the mean scores of female teachers is higher than the mean scores of the male teachers, It signifies that the female school teachers are having high scientific attitude than the male school teachers from the selected sample.

OBJECTIVE: TO STUDY CRITICAL THINKING AMONG MALE AND FEMALE TEACHERS
H$_{20}$: There exists no significant difference of critical thinking among male and female teachers.

| Table II t – Test Analysis of Critical Thinking Scores among Male & Female Teachers |
|---------------------------------|---|---|---|---|
| Gender           | N  | Mean  | Std. Dev. | t-value |
| Female          | 50 | 15.40   | 2.407       |         |
| Male            | 50 | 14.18   | 2.601       | 2.434*  |

* significant at 0.05 level

Table II shows Standard deviation of female teachers is 2.407 and of male teachers is 2.601 and the calculated t-value is 2.434 significant at 0.05 level. It signifies there is a difference between the critical thinking of male and female teachers. So the null hypothesis H$_{20}$: “There exists no significant difference of critical thinking among male and female teachers” has not been accepted. As the mean scores of female teachers is 15.40 which is
higher than the mean scores of the male teachers 14.18, it signifies that the female teachers are having high critical thinking than the male school teachers from the selected sample.

OBJECTIVE: TO STUDY SIGNIFICANT RELATIONSHIP OF SCIENTIFIC ATTITUDE AND CRITICAL THINKING AMONG ALL SCHOOL TEACHERS

H3O: There exists no significant difference of critical thinking and scientific attitude among teachers.

Table III Correlation Analysis of Scores of Scientific Attitude & Critical thinking of Teachers

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>r - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Attitude &amp; Critical Thinking</td>
<td>100</td>
<td>.369*</td>
</tr>
</tbody>
</table>

* Correlation is significant at 0.01 level (2-tailed)

It may be seen from Table III that the correlation between scientific attitude and critical thinking of total sample is 0.369 which is comparison to the table value was found to be significant at 0.01 level. It signifies some degree of positive association. So, H3O: “There exists no relationship of scientific attitude and critical thinking among teachers” is not accepted.

Research Findings of the Study

- There’s a difference between scientific attitude of male and female teachers.
- There’s a difference between critical thinking of male and female teachers.
- There exists relationship between scientific attitude and critical thinking among teachers.

Discussion of the Results

As from the findings of the study it can be elucidated that there is a difference between the male and female teachers on the variables of scientific attitude and critical thinking. For the present study the representative sample of male and female teachers are showing a high mean score of female teachers on both the variables; scientific attitude and critical thinking, means that female teachers are having significantly higher scientific attitude, open mindedness, curiosity, judgement based on verified facts, ready to test and verify conclusion, faith in cause and effect relationship, be ready to reconsider their judgement, be free from superstitions and false beliefs, honest in recording, collecting and reporting scientific data, being critical in observations than their male counterparts. There is a positive and significant relationship between the scientific attitude and critical thinking of male and female teachers signifying if there is increase in the magnitude of the variable scientific attitude there will be increase in the magnitude of the variable critical thinking. Both the variables complement each other. For the present sample, the relationship between the two variables of critical thinking and scientific attitude having the relationship of the magnitude .369 signify that there is positive and significant relationship between the two variables.

Conclusion

The present study had revealed many interesting findings females showing more scientific temper and critical thinking. Even the majority of teachers working in Punjab government’s primary school are female teachers. The study had indeed rejected old
established theories of male more rationally strong, critically analytic in approach, rational and objective in approach. Having scientific attitude is not only the needs skepticism but also humility. There would be no branch of new knowledge discovered without this scientific attitude. Critical thinking should be improved in teachers. It is a process of examining the offered evidence and reasoning, and forming reasonable judgments about the facts. Without the critical thinking ability, we would be misled to our high sight bias and overconfidence of our judgments.

References