

# Epistemological Stances Towards Knowledge in School Science and the Cultural Context of India

**Ravinder Koul**

*Pennsylvania State University, Great Valley, USA*

## **Background**

The declining student enrollment in sciences is a matter of serious concern for educators (Osborne, 2003). In attempts to remedy this problem, researchers have investigated and identified a list of factors that can influence positive attitudes towards school science which include religious affiliation, gender, personality, social structure, school, curriculum, teacher, classroom learning environment, etc (Schibeci, 1984; Simpson & Oliver, 1990; Myers & Fouts, 1992; Talton & Simpson, 1987). Studies in USA and Canada, for example, have shown that many students with deeply held religious values and beliefs have negative attitudes towards school science and experience difficulties in learning science or choosing a science career (e.g., Roth and Alexander, 1997; Ebbenshade, 1993). Ebbenshade (1993) found that of 121 high school students enrolled in a summer course on religion and science, 56% of boys and 43%

of girls reported that they had “very strongly” or “often” considered a scientific career. Of these students, 28% stated that their religious faith would interfere with that choice.

Researchers have reported attitudinal differences towards science without investigating the underlying habits of mind. For example, does a belief in religious authority predict a propensity to dismiss scientific evidence? Does this belief promote negative attitudes towards school science? Is open-mindedness unique to science? To religion? Is it an aspect of both? Good (2001) argues that open-mindedness, the habit of mind so essential to scientific pursuits, always conflicts with religious faith in the authority of scriptures and religious leaders. Gauld (2003), on the other hand, argues that developing a respect for evidence, empirical or otherwise, is common to both “good” scientific and

religious outlook. As yet, no study has examined what students of different orientations and habits of mind report as the social and psychological benefits of religion and school science. Better understanding of scientific and religious habits of mind might help to identify the sources of positive and negative attitudes towards religion and school science.

This study investigated relationship between religious orientation and attitudes towards religion and school science among high school students from a Himalayan region of India. The results of t-tests and multiple regressions reveal that the attitudes of these students were influenced by patterns of outlook common to both religious and scientific habits of mind. Self-fulfilling prophecy, cognitive need for explanation, and belief in authority are the patterns of outlook identified in this study. Each of the three thought patterns effected both positive and negative attitude towards religion and school science.

## Method

### Data source

Data was collected from eleventh and twelfth grade students (420 males and 614 females) in the predominately Hindu district of Chamba, Himachal Pradesh, India. More than 96% of respondents were from tribal (Gaddis, the nomadic shepherds of Chamba Valley) and non-tribal Hindu populations. Eighty percent of the responses were complete.

### Survey

Surveys were used with high school students in India. This Likert-Scale survey measured the beliefs or habits of mind about the purpose, benefits, and authority of religion and school science. The survey included Hindi translations of items from Althausser's (1990) "ultimate-instrumental scale". These items measured religious orientation in terms of *ultimate* and *instrumental* reasons for religion. An *ultimate* religious orientation focuses on the truth or content of religious beliefs, experience (reasoning), and revelation. An *instrumental* religious orientation focuses on social and psychological benefits of religion.

The items borrowed from Althausser's scale measured the effect of ultimate and instrumental orientations on the perceived benefits of religion. Other items in the survey were modified from Altemeyer and Hunsberger (1992) to measure "unquestionable faith in a fundamental, basic, and inerrant religion" or religious authoritarianism. The survey also asked if religious practices (introducing scriptures and religious prayer in schools) should be part of school curriculum. The survey measured the affirmation of statements regarding the psychological and social benefits of religion and

school science and the perceptions concerning the source of authority in school science.

## Results

In this study, *self-fulfilling prophecy* was one of three thought patterns found common to both scientific and religious outlook. A majority of students affirmed positively the statements about the utilitarian value of the ideas and theories of religion and school science. However, a minority had less positive perceptions of inevitable benefits from both religion and school science.

*Authoritarianism* was the second thought pattern common to both scientific and religious outlook. Religious authoritarianism is characterized by an emphasis on the acceptance of dogma and rituals with unquestioning faith. Similarly, scientism is characterized by a belief in the unquestionable authority of scientists, science teachers, and science textbooks. Johnston notes that "scientism is a system of belief about the utility of scientific endeavors, a set of practices (the scientific method), prophets of old (the founding fathers of modern science), sacred places (the laboratory, the computer room), supreme loyalty and commitment to its adherents, the missionary zeal with which the proponents try to win others to win their faith in science" (Johnstone, 2004, pg. 13-14). An authoritarian outlook negatively influenced student perceptions of the benefits of religion and school science.

*Cognitive need for explanation* was the third common thought pattern to emerge in this study. This is the need to explain the "what" and "why" of daily experiences. Students, in this study, perceived both science and religion as beneficial in answering the need to explain natural events in the physical environment. Results show a strongly positive association between cognitive need for religious explanation and perceived benefits of school sciences.

It might seem that the strong religious orientations among the majority of students would correlate with positive support for religious practices in schools (teaching scriptures and holding religious prayer in schools). However, statistically there was no significant association in this study between an ultimate religious orientation and student support for religious practices in schools. The religious intent of students was found to be a separate dimension from support for holding prayer or introducing scriptures in schools. There was an association between an instrumental religious orientation and support for religious practices in school, but it was very weak. While the study was not designed to capture conflicts in the religious and scientific outlooks (e.g., between cognitive needs for scientific and religious explanations), an authoritarian habit of mind among some students was found to have a significant

effect on their less positive perceptions of *both* religion and school science.

The results from this study indicate that positive and negative attitudes towards science and religion are more likely to be characteristics of general habits of mind, and are not limited to any domain of knowledge. Both scientism ('science as a form of religion') and 'religious authoritarianism' ('religion as a form of science') reflect such common habits of mind. Science educators have a major concern for the development of habits of mind that promote inquiry (e.g., Toulmin, Rieke, & Janik, 1979; Nagel, 1979). Future research could investigate the positive and negative influence of curriculum, teacher and classroom learning environment on specific thought patterns identified in this study.

## References

Aikenhead, G. (2000) *Integrating western and aboriginal science: Toward a bi-cultural pedagogy*. Paper presented at the annual Meeting of American Education Research Association, New Orleans.

Althaus, R. P. (1990) Paradox in popular religion: The limits of instrumental faith. *Social Forces*, 69(2), 585-602.

Altemeyer, B., & Hunsberger, B. (1992) Authoritarianism, religious undamentalism, quest and prejudice. *The International Journal of the Psychology of Religion*, 2(2), 113-133.

Carey, S., & Smith, C. (1993) On understanding the nature of scientific knowledge. *Educational Psychologist*, 28(3), 235-251.

Cobern, W. W. (1996) Worldview theory and conceptual change in science education. *Science Education*, 80(5), 579-610.

Driver, R., Leach, J., Millar, R., & Scott, P. (1996): *Young people's images of science*. Buckingham: Open University Press.

Ebbensshade, D. (1993) Student perceptions about science and religion. *The American Biology Teacher*, 55(6), 334-338.

Field, A. (2000) *Discovering statistics using SPSS for windows*. Thousand Oaks: Sage Publications.

Gauld, C. (2003) Habits of mind, scholarship and decision-making in science and religion. Paper presented at the 7<sup>th</sup> International Conference of History, Philosophy and Sociology of Science and Science Teaching, Winnipeg, Canada.

Good, R. (2001) Habits of mind associated with science and religion: Implications for Science Education. Paper presented at the 6<sup>th</sup> International Conference of History, Philosophy and Sociology of Science and Sci-

ence Teaching, Denver, USA.

Johnstone, R. L. (2004) *Religion in society: A sociology of religion*. Upper Saddle River, NJ: Pearson Prentice Hall.

Kemp, A. C. (2000) Scientific literacy for all: Rationales and realities. Paper presented at American Education Research Association, Washington, DC.

Koul, R. (2003) Revivalist thinking and student conceptualizations of science/religion. *Studies in Science Education*, 39, 103-124.

Lawson, A.E. (2001) Sound and faulty arguments generated by preservice biology teachers when testing hypotheses involving unobservable entities. *Journal of Research in Science Teaching*, 39(3), 237-252.

Merton, R. K. (1968) *Sociology and social structure*. New York: Free Press.

Osborne, J. (2003) Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049-1079.

Roth, W. M., & Alexander, T. (1997) The interaction of students' scientific and religious discourses: Two case studies. *International Journal of Science Education*, 19(2), 125-146.

Rudolph, J.L., & Stewart J. (1998) Evolution and the nature of science: On the historical discord and its implications for education. *Journal of Research in Science Teaching*, 35(10). 1069-1089.

Schibeci, R. A. (1984) Attitudes to science: an update. *Studies in Science Education*, 11, 26-59.

Simpson, R. D., & Oliver, J. S. (1990) A summary of the major influences on attitude toward and achievement in science among adolescent students. *Science Education*, 74, 1-18.

Myers, R. E. & Fouts, J. T. (1992) A cluster analysis of high school science classroom environments and attitude toward science. *Journal of Research in Science Teaching*, 29, 929-937.

Nagel, E. (1979) *The structure of science: Problems in the logic of scientific explanation*. Indianapolis: Hackett.

Talton, E. L., & Simpson, R. D. (1987) Relationship of attitude towards classroom environment with attitudes toward and achievement in science among tenth grade biology students. *Journal of Research in Science Teaching*, 24, 507-525.

Toulmin, S., Rieke, R., & Janik, A. (1979) *An introduction to reasoning*. New York: McMillan Publishing.