



SCIENCE TEACHERS' PERSONAL EPISTEMOLOGY AND INQUIRY BASED TEACHING

**Mahmood Ahmed Dool¹, Ammat-Ur- Rahman Soomro², Abdul Karim Suhag³
and Maryam Hussain⁴**

¹Assistant Professor, Department of Education, IBA Sukkur University, Sindh, Pakistan

²Lecturer Chemistry, Education & Literacy Department Government of Sindh, Government (MARS) Girls, College Khuhra, Sindh, Pakistan

³Lecturer, Department of Education, SMI University, Karachi, Pakistan

⁴MS Scholar, Department of Education, SZABIST, Karachi Campus

ABSTRACT: *The aim of this discussion is to highlight the importance of education generally and science education particularly. Moreover, it tries to investigate the relationship between science teachers' personal epistemology & science education generally and inquiry-based teaching particularly followed by the summary.*

KEYWORDS: Science Teachers, Epistemology, Inquiry Based Teaching, Education

INTRODUCTION

Education serves as an agent for development and it has contributed to the independence of men hence, they value it a lot (Comfort, Usen & Ekpenyong, 2013). Education makes people aware of what is happening around them, make them conscious of the importance of independence, create optimism among people, and remove the ignorance. Hence, quality education becomes imperative for all and sundry. Pakistan, being a developing country, has been facing many problems, including joblessness, poverty, ethnic, tribal and religious conflicts as well as poor education. Among all of these, education is the most deprived and legged behind field (Farooq, 1994). To gain a status among international community, Government of Pakistan is continuously being spending a lot on initiative taken for the development of education. These initiatives include development science curriculum, arranging professional development trainings for science teachers accordingly, and making science laboratories functional.

The objective of this discussion is to highlight the personal epistemology of science teachers and explore its impact on their teaching practices particularly inquiry-based science education. The essential purpose of this debate is to decipher the concept that how science teachers' personal epistemology compels them to make a plan for inquiry-based science education. Moreover, this study will be helpful to make aware and conscious science teachers generally and community college science teachers particularly that how their personal epistemology helps them to employ inquiry-based science teaching effectively in their respective colleges.

Globalization has compelled to realize the need of science subjects and mathematics courses education is ever increasing (Chiu & Duit, 2011). Science education is a key element in



developing scientific literacy and in understanding the world and our role in it. In 21st century, one of the vital elements for the development of human civilization is education of science. In education, the science education and technology education domains are worse than other fields of education. Along with other many reasons, one of the main reasons of lagging behind in science teaching, learning & assessment is teachers' inappropriate teaching methodologies & their lacking in pedagogical skills of science teaching. No teacher teaches while following any teaching method but as per his/her belief regarding teaching and learning, called epistemology (Mahmood, 2007). In the history of Pakistan, National Education Conference was the first effort to highlight importance of education. The Quaid -i- Azam in his presidential address clearly declared that the education we will impart to our generation will be directly proportional to their grooming. The Constitution of Pakistan (1973) recognized that education is one of the basic rights of every citizen and highly prioritizes it. The government accepts its responsibility to provide access to education to every citizen. Article 37 enshrined in chapter two, 'Principles of Policy' of Constitution of Pakistan (1973) talks about the education as: by providing free and compulsory education as early as possible in order to maximize literacy which can improve economic conditions of the retrograde population.

Likewise, the national educational policy also stresses the need of student-centered methods to teach science, specifically inquiry-based teaching method (Halai, 2012). Development of National Curriculum (2006) was one of the good steps towards the inquiry-based science education. According to National Educational Policy (2009) also emphasized on provision of quality education. Likewise, science teachers employing conventional science pedagogies face difficulties in implementing inquiry-based teaching in their classroom because of their positivist epistemology (McDaniel, Rohrer & Bjork, 2008).

Natural science subjects like biology, chemistry, physics and general science are core subjects in Pakistani secondary school curricula. However, there are few schools that promote self-centered strategies of teaching which include questioning, authentic assessment, and inquiry-based teaching. As a number of training programs have been initiated for science teachers, teachers are encouraged to use inquiry-based science teaching as it is suitable strategy for science teaching (Anderson, 2002). As a matter of fact, Pakistan is continuously struggling for the respectable status in relation to science and technology (Anwer, Iqbal & Harrison, 2012).

Not to mention, inquiry-based science teaching refers to the active search of knowledge or understanding to satisfy a curiosity (Tenwa, 2014). In our country science teachers lack both in content as well as pedagogical content knowledge which enable them to teach science effectively (Tenwa, 2014). Resultantly, they employ traditional teaching methodology, restrict students from asking questioning and only use textbook as holy bible. In addition, it has been noted that science teachers teach science like they teaching a language in which teachers describe comprehension of science concepts, where students read the text and teachers explains the different terminologies. This is the reason most education policies and reforms highly emphasize the quality education of science subject particularly.

Teaching is the product of teacher's perception and beliefs (Alabdulkarim, 2016). Beliefs affect individual's behavior and it helps individual in understanding the world (Jamalzadeh & Shahsavari, 2015). In this regard, first comes the epistemology, the branch of philosophy which deals with not only the nature & process of acquiring the knowledge but with the value and importance of knowledge also. Whereas one's personal epistemology means someone's personal views regarding nature, process and value of knowledge. Science teachers are not



common like other teachers as they teach the ideas while proving these with experiments and observations. For creating such an experimental and observational environment, they have to adopt such teaching strategies which make the learners curious. The teachers' personal epistemology is highlighted in their teaching practices particularly student-centered, and such teachers' instruction related beliefs are communicated (Key, 2003).

Understanding the personal epistemology of science teachers is very important so that the actual beliefs of the teachers and stated beliefs in teaching of science could be differentiated. From two basic beliefs of teachers, the first one, the positivist perspective focusses on the traditional methods of teaching, where knowledge is fixed which neither be questioned nor be altered in anyway (Fuller, 1988). In this teacher, being a source of knowledge, has to transfer the fixed knowledge to the students as it is. Whereas the second one, post-positivist perspective also called structuralism perspective, while totally differing the traditional view point of teaching science, considers teaching science neither fix nor universal. It can be questioned and changes with the passage of time and with new inventions as well as discoveries. Both also differ in assumptions of acquiring the knowledge. Post-positivism argues that knowledge, while not being fix, is not passed from teacher to student, but it can be constructed and contextualized in scientific way. In other words, as knowledge is not the combination of facts and figures but learns must be made able to construct their own meaning of scientific knowledge (Wildemuth, 1993). Contrary to Schromer (1990) arguments that 'Personal Epistemology is based on sovereign beliefs, which mostly improve independently. She proposes four dimensions of knowledge, i.e. 1. Structure, 2. Certainty, 3. Stability (of knowledge) and 4. Ability to learn knowledge. She also argues that all of these may develop at the same rate. As the study of which talks about the nature as well as scope of knowledge and valid beliefs is termed as epistemology (Pintrich, 1997). Moreover, it discusses nature of knowledge in connection with like ideas for example: belief and truth (Hofer & Pintrich, 1997). But later researchers, Sandoval (2005) define personal epistemology totally in a different way. Personal epistemology focusing the nature of knowledge and the way of knowing it, rather concentrating on views about nature of learning.

If personal epistemology is taken from its origin, who first used this term in his 'scheme', which is based to understand that students studying in schools and colleges recognize knowledge. Additionally, the accepted wisdom they carry the way of knowing actually is cognition of thinking as well as reasoning. He opined that every student of college cross via recognizable stages order of growth of epistemology. In short, this scheme deals with epistemic issues related to critical thinking and learners' views related to nature and absorption of knowledge (Moore, 1994).

SUMMARY

It is exploring that working on teachers' affective domain is equally important to cognitive and psychomotor domain. Because by involving science teachers in trainings and continuous professional development programs we may enhance only subject matter knowledge and pedagogical content knowledge but cannot change their attitude. Therefore, it is imperative to work on science teachers' personal epistemology so that they may impart quality science education in their respective institutions.



REFERENCES

- Alabdulkarim, S. A. (2016). The impact of Science Teachers' Beliefs on Teaching Science: The Case Study of Saudi Science Teachers. *Journal of Education and Learning*, 5(2), 233.
- Anderson, R. D. (2002). Reforming science teaching: What research says about inquiry. *Journal of Science Education*, 13(1), 1-2.
- Anwer, M., Iqbal, H. M & Harrison, C. (2012). Students' attitude towards science. A case of Pakistan. *Pakistan Journal of Social and Clinical Psychology*, 9(2), 3-9.
- Chiu, M.-H. & Duit, R. (2011). Globalization: Science education from an international perspective (editorial). *Journal of Research in Science Teaching*, 48(6), 553-566.
- Comfort R. Etor1, Usen F. Mbon1 & Ekpenyong E. Ekanem1 (2013). Primary Education as a Foundation for Qualitative Higher Education in Nigeria. *Journal of Education and Learning*, 2 (2), 155-164.
- Farooq, R. A. (1994). Education system in Pakistan: Issues and problems, Asia Society for PR.
- Fuller, S. (1988). *Social epistemology*. Wiley Online Library.
- Halai, N. (2012). Developing Understanding of Innovative Strategies of teaching through action research: A qualitative Meta-Synthesis from Pakistan. *International Journal of Science and Mathematics Education*, 10(2), 387-415.
- Hofer, B. K. and P. R. Pintrich (1997). "The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning." *Review of educational research*, 67(1), 88-140.
- Jamalzadeh, M. & Shahsavar, Z. (2015). The Effects of Contextual Factors on Teachers' Beliefs and Practices. *Procedia-Social and Behavioral Sciences*, 192(4), 166-171.
- Keys, M. P. (2003). *Primary and Secondary Teachers Shaping the Science Curriculum: The Influence of Teacher Knowledge*. Queensland University of Technology.
- Mahmood, N. (2007). "Elementary School Science Teachers' Belief about Science and Science Teaching in Constructivist Landscape."
- Moore, W. S. (1994). "Student and faculty epistemology in the college classroom: The Perry schema of intellectual and ethical development." *Handbook of college teaching: Theory and applications*, 45-67.
- Constitution of Pakistan. (1973). *The Constitution of Pakistan 1973*. Government of Pakistan, 771-773.
- Government of Pakistan. (2009). *National Education Policy 2009*. Government of Pakistan, 42-43.
- Nayer. A.h. (2016). Science education in Schools. *Dawn News*. Retrieved from: <https://www.dawn.com/news/1243391>.
- McDaniel, M. Rohrer, D. & Bjork, R. (2008). Learning Styles. Concepts and evidence. *Psychological science in the public interest*, 9(3), 105-119.
- Sandoval, W. A. (2005). Understanding students' practical epistemologies and their influence on their learning through inquiry. *Science Education*, 89(4), 634-656.
- Schromer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82(3), 498.
- Tenwa, Y. A. (2014). Teachers' attitude, experience and background knowledge effect on the inquiry method of teaching.
- Wildemuth, B. M. (1993). "Post-positivist research: two examples of methodological pluralism." *The Library Quarterly*, 63(4), 450-468.