SCIENCE TEACHERS’ BELIEFS ON TEACHING AND LEARNING AT SECONDARY SCHOOLS IN BANGLADESH

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Abstract

The present study intends to explore the science teachers’ beliefs on nature of teaching and learning of secondary schools in Bangladesh. Common aspects of teaching and learning- curriculum, teacher and student roles, teaching strategies, and classroom organization- were taken into account to reveal teachers belief. By using translated version (in Bengali) of Teaching and Learning International Survey (TALIS) questionnaire survey and follow up interviews, data was collected. The respondents of the study were 253 science teachers that were selected by using purposive sampling technique. The TALIS data collection instrument ‘’-a four-point Likert scale, ranging from 1= “strongly disagree” to 4 = “strongly agree”, is used for identifying basic dimensions -the direct transmission view and the modern view- of teachers’ belief about teaching and learning. Ipsative scores of the teachers’ responses were computed to determine overall tendency for accepting any of the belief dimensions of various aspects of teaching and learning. The results of the study have revealed that science teachers’ belief regarding teaching and learning did not partition within a particular belief dimension. Teachers possessed direct transmission (traditional) belief regarding student role and classroom organization aspects of teaching and learning. On the other hand, the respondents’ support of modern belief on teacher role, curriculum, and teaching style aspects of teaching and learning are stronger than that direct transmission belief. Analysis of interviews supported these findings. The study also revealed that teachers’ belief did not vary in case of gender but formal education, teaching experiences and trainings were shown divergence. As teachers’ beliefs have strong influence on actual practice therefore, this study suggests that a further study is needed to explore the links between teachers’ beliefs and practices in an ideal setting to understand whether their beliefs are really reflected in actual practices or not.

Keywords: Modern; Traditional; Teachers belief; Science teaching and learning; Secondary school teachers; Bangladesh

1. Introduction

Low student achievement in science especially in secondary level is a major concern in many countries. Without considering the countries socio-economic status, low enrollment and low interest in science are the most critical concern in science
education. According to Nelleke, et al. (2010) and Tsai (2002), two of the rationales are well established for these states: a) the way science is taught and b) student often perceive science education to be limited because most topics of the science curriculum are chosen by the teachers. Therefore, the role of science teachers is increasingly attention (Osborne, et al., 2003; National Research Council, 1996; AAAS, 1989; Bybee, 1993) not only the fact that students’ enjoyment of science subjects is highly affected by teacher behavior (Darby, 2005) but also teachers are viewed as key components in the current endeavors to reform science curricula (Tobin et al., 1994). Previous research (for example, Anamuah-Men'sha, and Asabere-Ameyaw & Mereku, 2004) reported that the low achievements are attributed to poor quality of teaching. It has been demonstrated that quality of instruction is fundamental to student learning (OECD, 2009). In contrast, a substantial body of research suggests these teachers’ beliefs and values about teaching and learning affect their teaching practices (Vaiteka & Fernandez, 2010; Clark & Peterson, 1986; Nespor, 1987; Wolley et al., 2004; Nelleke, et al., 2010; Markic & Eilks, 2010; Prawat, 1992; Haney et al., 2003; Brousseau, et al., 1998; Jones & Carter, 2007; Pedersen & Liu, 2003; Fulton, 1999; Tsai, 2004; Levitt, 2002; OECD, 2009; Fang, 1996; Kagan, 1992; Thompson, 1992; Stipek, et al., 2001; Pajares, 1992; Tobin et al., 1994). People’ ‘beliefs’ are important influences on the ways they conceptualize tasks and learn from experience (Clark & Peterson, 1986). Bandura (1986) stated that beliefs represent the best indicator of why one person behaves acts, and makes decisions in a certain way. Kobella et al. (2000) concluded that beliefs influence all kind of interactions between teachers and pupils and also suggested that teachers’ beliefs about teaching and learning always include aspects of beliefs exclusive to their chosen discipline or subject. Maor and Taylor (1995) concluded that, even in computerized classroom environments, teachers’ epistemologies continue to perform an essential role in mediating the quality of student science learning. In their view, teachers’ epistemologies are mainly concerned with pedagogical beliefs about teaching and learning (cited in Tsai, 2002). Nespor (1987) stated various belief systems and their role in teaching and learning especially non-consensuality, existence beliefs, and beliefs in alternative worlds make belief systems very important determinants of how individuals organize the world into task environment and define tasks and problems (Nespor, 1987, p. 322). Pajares (1992) illustrate the notion that beliefs play a critical role in defining behavior and in organizing knowledge and information.

In educational research, beliefs about teaching and learning are categorized into two dimensions- Traditional and Modern (OECD, 2009; Wolley et al., 2004). These two belief dimensions are variously termed as direct vs. indirect; conventional vs. contemporary; teacher-centered vs. student-centered approach of teaching-learning process. Recent reforms of science education are based on modern (constructivist) theories of learning (Fosnot, 1996). Discussion of modern teaching dominate many professional conferences and scholarly and practitioner journals (Wolley et al., 2004). A reflection of modern approaches are shown in state and local policies and in the K-12 standards set by many professional organizations, including the National Council for Teachers of Mathematics, the National Science Teachers Association, and the National Council of Teachers of English with the International Reading Association (Fosnot, 1996).

In line with this global trend, modern approach (learning through experience) of teaching and learning are portrayed in newly developed secondary teacher
education curriculum of Bangladesh where the method of teaching is actively involve the students in the learning process. One of the philosophical foundations that guided the curriculum is:

*Teaching is characterized by creative use of available resources, a wide range of participatory approaches, strategies and skill and the use of assessment as a tool in learning; provide enhanced learning opportunities for their students* (MoE, 2006).

It is stated that the role of the teachers’ should frequently be that of facilitator. The main responsibilities of the teachers in this role are to organize and maintain an environment that is conducive to learning. This is a collaborative model in which the teacher creates a learning community that is learner centred, developmentally oriented and problem focused (MoE, 2006).

As newly developed curriculum which firmly stands in the modern view of science teaching and learning is introduced in Bangladesh it is timely to investigate Bangladeshi teachers’ beliefs of science teaching and learning to see if these beliefs coincide with the intentions of the most recent curriculum. Although a lot of research regarding teachers’ beliefs has been carried out in western countries, research regarding beliefs is still scarce in South-Asian countries. This study, therefore, is an initial effort regarding teachers’ beliefs on teaching and learning especially in Bangladesh. The result of this study is expected to provide information especially teacher educators, teachers and curriculum developers and other stakeholders about the beliefs on teaching and learning at secondary levels science teachers in Bangladesh. The purpose of this study is to explore the belief of Bangladeshi science teachers regarding teaching and learning aspects.

### 1.2. Theoretical perspectives of teacher’s beliefs about teaching and learning

A diversified set of beliefs regarding teaching and learning are reported in various literatures (see Jones & Carter, 2007; Samuelowicz & Bain, 2001). Prawat (1992) discusses four questionable set of beliefs about teaching and learning which are core of the educational enterprise because they influence many aspects of teachers behavior as follows:

*Learner and content as relatively fixed entities:* The fact that teachers view content and students in static, noninteractive terms explains why so much time and attention is devoted to delivery of content instead of more substantive issues relating to content selection and meaning making on the part of students. In the context of a fixed set of curricular demands, variation in the style and pace of instruction may be perceived as only way to accommodate what are regarded as equally hard and fast individual differences.

*Naïve constructivism:* This set of beliefs is just as problematic form a constructivist perspective: This is the tendency to equate activity with learning- a notion that Dewey attempted to counter. He argued that student engagement is not the best measure of educational value.

*Constructivism:* This set of beliefs perpetuates a distinction that would like to do away with: that between comprehension and application, learning and problem
solving. It may be the most intractable of the four under consideration. The comprehension-application distinction is intuitively appealing and supported by research on transfer; it has also been legitimated in various taxonomies of educational outcomes.

*Fixed curriculum:* The popular view of curriculum as fixed agenda, a daily course to be run that consists of preset means (i.e., a certain material to cover) and predetermined ends (i.e., a discrete set of skill or competencies). Many constructivist, favor a more interactive and dynamic approach to curriculum, believing that it should be viewed more as a matrix of ideas to be explored over a period time than as roadmap. One would enter this matrix at various points depending on where students are in their current understanding.

However, by considering the teaching-learning aspects-curriculum, teachers and students roles, teaching strategies, and classroom organization most educator differentiate teaching beliefs into traditional and modern dimensions (Fulton, 1999; OECD, 2009; Wolley et al., 2004; Levitt, 2002).

The teacher-centered classroom (the traditional dimension teaching) is a central elements of transmission based on behaviorist approach to teaching and learning. Psychologists working within this paradigm are interested in the effect of reinforcement, practice, and external motivation on a network of associations and learned behaviors (Fosnot, 1996). Educator using such a behaviorist frame work preplan a curriculum by breaking a content area (usually seen as a finite body of predetermined knowledge) into assumed component parts “skill” and then sequencing these parts into a hierarchy ranging from simple to more complex. It is assumed (1) that observations, listening to explanations from teachers who communicate clearly, or engaging in experiences, activities, or practice sessions with feedback will result in learning and (2) that proficient skills will quantify to produce the whole or more encompassing concept (Bloom, 1956; Gagne, 1965, cited in Fosnot, 1996, p. 9). Further, learners are viewed as passive and they are simply tested to see where he or she falls on the curriculum continuum and then expected to progress in a continuous, quantitative fashion as long as clear communication and appropriate reinforcement are provided (Fosnot, 1996, p. 9).

Modern theory of learning, in contrast, has a dozen bands (Geelan, 1997a, cited in Dawkins, 2004), each of which emphasizes a different aspect of learning, most agree that it involves a dramatic change in the focus of teaching, putting the students’ own efforts to understand at the centre of the educational enterprise (Prawat, 1992). There are two principles in modern learning theory that would likely be found in every one:

- Students construct their own understandings
- The new understandings that student construct rest on the foundations of knowledge and understandings that they already exist (Dawkins, 2004, p.107)

The adoption of such an approach to teaching and learning would result in major changes in the teachers’ role. Thus, in all modern teaching-learning scenarios, the traditional telling-listing relationship between teacher and student is replaced by one that is more complex and interactive (Prawat, 1992).

Fosnot (1996), draw an image of such a more complex and interactive teaching-
learning scenarios. According to her, perhaps first and foremost, the phenomenon students are asked to think about needs to be interesting, worthy of engaging their time and attention. In addition, it should offer a variety of avenues for exploration various routes of approach. Once these parameters are established, the teachers needs to listen carefully to students’ interpretation of data, paying particular attention to any individual’s conundrums, puzzlements, confusions. And the teachers equally needs to pay attention to differences of opinion within the class, giving equal respect to each one, for as long as any student still takes it seriously. By focusing on puzzlements

and contradictions, the teachers establishes the notion that ideas are complicated and worthy of time and consideration and that each student is capable of formulating interesting ideas. Further, the teacher acknowledges that “not knowing” is a state that is important to live with-the state that most of us are in most of the time (Fosnot, 1996, p. 71). Such a type educational enterprise, students are encouraged to express feeling related to their work (their frustrations as well as their interests), and to considered the entirety of the learning process within a playful learning environment. On the basis of theoretical framework a summary of modern and traditional teaching aspects are given in the table1.

Tsai (2002) categorized student teachers’ beliefs about teaching, learning and science as traditional, process oriented, or constructivistic. In his study, the majority of 37 Taiwanese science teachers held traditional beliefs. More importantly, over half of these student teaches has beliefs about teaching, learning and science that that were closely aligned. Tsai (2006) performed an evaluation of the relationship between the different beliefs. He concluded that “adequate coherence” existed between the subjects’ scientific epistemological beliefs and their classroom teaching.

Levitt (2002) in his study tried to ascertain the beliefs of elementary teachers regarding the teaching and learning of science and the extent to which the teachers’ beliefs were consistent with the philosophy underlying science education reform. Sixteen teachers from two school districts involved in a local systemic initiative for science education reform participated in the study. Data was collected through classroom observation and interview with the teachers. One overarching belief emerged: teachers believed that the teaching and learning of science should be student centered. The study also revealed gaps between teachers’ beliefs and the principles of reform and suggested that the teachers are moving in a direction consistent with science education reform.

Markic & Eilks (2010) described a broad and triangulated picture about the science student teachers’ beliefs on teaching learning science from four different domain of science teaching.
Table 1: Aspects of Traditional vs. Modern teaching

<table>
<thead>
<tr>
<th>Teaching aspects</th>
<th>Traditional belief</th>
<th>Modern belief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching strategy</td>
<td>Teacher-centered, teacher lectures, clearly communicating predetermined knowledge;</td>
<td>Student-centered, student set their own goal, determine resources, and activities that will help them meet those goals, hands-on activities, practical work, investigation.</td>
</tr>
<tr>
<td>Teacher role</td>
<td>Dispense accurate knowledge; set learning goal, and check student knowledge by searching predetermined response. This is teacher who will determine what to teach and how to teach as a dictator.</td>
<td>Facilitator, help student to develop their own inquiry, listen carefully to students’ interpretation of data, paying particular attention to any individual’s conundrums, puzzlements, confusions. Student ideas (correct or incorrect) are always respected.</td>
</tr>
<tr>
<td>Student role</td>
<td>Passive role, teacher directed, recipient of information, listening to explanation from teachers, taking notes, raising questions only occasion, learning until mastery.</td>
<td>Active role, creator of knowledge as an autonomous explorer. Self-directed learning.</td>
</tr>
<tr>
<td>Curriculum</td>
<td>Popular view, planed and well sequenced structured curriculum, a finite body of predetermined knowledge; fixed and rigid in nature.</td>
<td>More interactive and dynamic curriculum like as matrix. Relaxed and flexible. Focusing on thinking and understanding by problem solving or inquiry.</td>
</tr>
<tr>
<td>Classroom organization</td>
<td>Whole class instruction, routine activities, more formal, calm and quiet in nature.</td>
<td>Offer a variety of avenues for exploration various routes of approach. More casual, many things happening; small or peer group.</td>
</tr>
</tbody>
</table>

A mixed method approach was adopted to conduct this research. The results suggest that beginning chemistry and, even more pronouncedly physics student teachers profess quite traditional beliefs about teaching and learning science. Biology and primary science student teachers express beliefs towards teaching and learning in their subjects more in line with modern educational theory.

Aguirre, et al. (1990) showed that science student teachers often conceptualize teaching as ‘a knowledge transfer’ or an influence or change in understanding’. They view learning as ‘an intake of knowledge,’ ‘an attempt to make sense in terms of existing understanding’ or ‘an effective response’. Koballa et al. (2000) described...
German chemistry student teachers’ beliefs as reproductive rather than constructive. Fischler (1999) evaluated German physics student teachers’ beliefs in terms of thinking about their own physics classes at school. The usual response was a very dominant teacher, very passive pupils, and bad images of physics.

In Germany, Niehaus and Vogt (2005) performed a study with Biology teachers and student teachers. The study showed that biology (student) teachers’ beliefs are a mosaic of different categories and cover a wide range without showing any clear tendency towards more conventional or more traditional beliefs.

2. Research Method

An interpretative research framework of Strauss & Corbin, (1990) was chosen to conduct this study. It focuses on the in-depth meanings that participants ascribed to the emphasized on nature of teaching and learning aspects. The data was collected from February 12, 2012 to March 27, 2012.

2.1. Participants

This research is based on qualitative research framework. One of the main features of this framework is to work with purposively selected small samples of people, nested in their context and studied in-depth (Miles & Huberma, 1994). The purposive sampling technique is a type of non-probability sampling that is most effective when one needs to study a certain cultural domain with a specific type of knowledge or skill (Vargas & van Andel, 2005). Acknowledging the framework, this study purposively selected two hundred and fifty three (253) science teachers from secondary schools at Dhaka city (see table 2) to gather information regarding teaching and learning. Among them 89 was female. The age of the participating teachers ranging between under 25 up to 60 years old with teaching experiences ranging between one (1) year to more than 20 years. Formal education of the participant teachers lay in between bachelor and master and even up to PhD; all of them have Bachelor Degree in Education (B.Ed.); 116 of them received training on Subject Based Cluster (SBC); Continuous Professional Development (CPD) training received by 137; and Teaching Quality Improvement (TQI) training received by 241 teacher participants. TQI training, which started in 2006, mainly focuses on the participatory teaching approach to develop students’ understanding and thinking skills of science.
2.3. Data Collection Instrument

2.3.1. Survey instrument

The instrument for data collection of the study is a translated version (in Bengali) of Teaching and Learning International Survey (TALIS), originally designed by OECD (2009). The TALIS data collection instrument – a four-point Likert scale, ranging from 1 = “strongly disagree” to 4 = “strongly agree”, is used for identifying basic dimensions - the direct transmission view and the modern view- of teachers’ belief about teaching and learning. Two dimensions for teachers’ beliefs about teaching comprise the following questionnaire items (see table 3).

A careful review of the instrument revealed that the instrument is intended to reflect a “representative sample” of beliefs for each of Schwab’s (1958) four common places (teachers, students, curriculum and classroom environment as social milieu) of schooling, plus a fifth category designed to capture beliefs about teaching strategies/teaching style (see appendix A).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Year of teaching experiences</th>
<th>Formal education</th>
<th>In-service Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male(M)</td>
<td>164</td>
<td>Under 25</td>
<td>6</td>
<td>1st year</td>
</tr>
<tr>
<td>Female (F)</td>
<td>89</td>
<td>25-29</td>
<td>37</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>30-39</td>
<td>111</td>
<td>3-5</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>40-49</td>
<td>77</td>
<td>6-10</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>20</td>
<td>11-15</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>2</td>
<td>16-20</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20+</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>253</td>
<td>253</td>
<td>253</td>
<td>253</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Table 3. Teachers’ beliefs about teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct transmission(traditional) beliefs about teaching</td>
</tr>
<tr>
<td>• Effective/good teachers demonstrate the correct way to solve a problem</td>
</tr>
<tr>
<td>• Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly</td>
</tr>
<tr>
<td>• How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary</td>
</tr>
</tbody>
</table>
• A quiet classroom is generally needed for effective learning

• It is better when the teacher – not the student – decides what activities are to be done.

Modern beliefs about teaching

• My role as a teacher is to facilitate students’ own inquiry

• Students learn best by finding solutions to problems on their own

• Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solve

• Thinking and reasoning processes are more important than specific curriculum content

• I ask my students to suggest or to help plan classroom activities or topic plan classroom activities or topic

Adopted from OECD, 2009

2.3.2. Interview instrument

The semi structured interview protocol containing six items was developed with the coherence of survey instrument (see appendix B). In the interview protocol the participants were asked about “best ways of teaching; teacher’s responsibilities; ideal science teaching environment; best ways of learning science; student’s responsibilities; and learning contents” in a desire to develop a deep profile of the participants’ beliefs about teaching and learning.

2.4. Data collection procedure

2.4.1. Distribution and collection of surveys

Researcher along with three others research assistants were involved in distributing and collecting surveys. The research assistants were graduate students of the Institute of Education and Research, Dhaka University. As teachers are remain busy with various types of responsibilities, they were given time to complete the survey within one week after distribution. A total of 350 survey instruments were distributed while 253 were returned. From February 12, 2012, to March 27, 2012, distribution and collection of surveys were accomplished.

2.4.2. Interview

By using maximum variation sampling technique (Glaser & Strauss, 1967) ten of the participants teachers from same pool of survey respondents (see profile in table 4) were selected and interviewed. All interviews were conducted by researcher during the school day in the teachers’ school during a free period. With due permission of the
school heads, the subject was requested to sit for interview. The interview began with the researcher giving participants background information on the study and the purpose for the interview. Participants were encouraged to be open and candid in their responses, and assured that they would remain anonymous for reporting purposes. Each interview followed the semi structured interview protocol which is open ended in nature. It lasted for about 25-30 minutes and audio-taped and transcribed for analysis.

Table 4. Demography of the interview respondents

<table>
<thead>
<tr>
<th>Background Factors</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
<th>P9</th>
<th>P10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Years of Teaching experience</td>
<td>5</td>
<td>5</td>
<td>&gt;15</td>
<td>6</td>
<td>14</td>
<td>9</td>
<td>17</td>
<td>12</td>
<td>&gt;10</td>
<td>11</td>
</tr>
<tr>
<td>Subject taught*</td>
<td>P</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>P</td>
<td>B</td>
<td>P</td>
<td>P</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>3 month</td>
<td>3 month</td>
<td>3 month</td>
<td>3 month</td>
<td>3 month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>overseas training</td>
<td>overseas training</td>
<td>overseas training</td>
<td>overseas training</td>
<td>overseas training</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P= Physics, C= Chemistry, B= Biology

2.5. Data Analysis

2.5.1. Computation of Ipsative score for survey

For teachers’ beliefs about teaching and learning, ipsative scores were computed by subtracting the individual mean across all of the ten items measuring teachers’ beliefs from the individual mean across the five items belonging to the index direct transmission beliefs about teaching and learning and also from the five items measuring modern beliefs about teaching and learning. Thus, mean scores were calculated for both indices and corrected for the overall tendency to accept any of the belief items. The means across both indices average zero for each teacher. The resulting score of an individual teacher is the relative endorsement of this index or the relative position of the individual on one index in relation to the other index. Positive score values indicate that one set of beliefs receives a relatively stronger support than the other. The ipsative process, a technique which can reduce systematic response bias which exists between groups in a study (Cunningham, et al., 1997). Calculating ipsative scores is an approach to standardizing individual responses to express them
as preferences between two or more options and thus helps reduce the effects of response bias (Fischer, 2004 cited in OECD, 2009). Since this study, focused teaches having variation in age, education, experience, discipline (P, C, &B) and training and given them options in expressing their views therefore, the technique was found appropriate for this study.

2.5.2. For interview transcript

Interview transcripts were analyzed in searching of communalities and uniqueness (Miles & Huberman, 1994) in a desire to generate a deep profile of the participants’ views about teaching and learning. After carefully examining teachers’ interview transcripts a summary was developed by using descriptors (Some synonyms and similar terms were represented by the same descriptors) or coding keywords (see table 5) that were shown in teachers’ beliefs about teaching and learning. For example, giving accurate knowledge, presenting facts, giving accurate information from authentic source, inculcating knowledge, were coded into a descriptor ‘accurate information’ about teachers’ belief about teaching in traditional belief dimension. After that, the summaries were searched for pattern and/or categories. These categories were then checked against confirmatory or otherwise contradictory evidence in the data and modified accordingly. Thus, conducted several rounds of category generation, confirmation, and modification to satisfactorily reduce and organize the data. This process was repeated for all questionnaires. Koballa et al., (2000) and Tsai (2002) applied same process for analyzing interview transcript.

Table 5. Descriptors (Coding keywords) are used to describe teaching and learning under belief dimensions

<table>
<thead>
<tr>
<th>Belief dimensions</th>
<th>Keywords for Teaching</th>
<th>Keywords for Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>transferring of knowledge; giving concrete answer, providing clear definition, giving accurate information; communicating predetermined knowledge; demonstrating accurate way to solve problem; conducive atmosphere instructing whole class; Passing the exam; promoting next grade; completing syllabus; cutting a good score of science; precisely delivering of knowledge</td>
<td>recipient of information; memorizing formula, definition, and scientific fact; listening teachers talk carefully; copying what teachers do; passive listening; hard work on practicing class works; repeat until mastery learning; finding the right answer; accurate way to solve problem; practicing solving problem</td>
</tr>
<tr>
<td>Modern</td>
<td>helping students to make interpretation; guiding student to make meaning; providing authentic experiences; interacting with students; encouraging discussion and cooperative learning; allowing student learn by themselves; paying attention to students’ prior knowledge</td>
<td>independent learning; making interpretation; exploring or coping with authentic experiences; discussing with peers and teachers; relating to prior knowledge or experiences;</td>
</tr>
</tbody>
</table>

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knowledge, puzzlements, conundrum; playing with students as a friend; allow students to express their feelings; let student discuss to come up a solution; making decision; generating new ideas; expressing various ways; developing their own definition; varieties of teaching experiences.

seeker of knowledge; developing understanding; enhancing thinking ability.

3. Results of the study

Table 6 shows the results of the survey of teachers’ beliefs about teaching and learning. Table 7 shows the matrix of the interview responses of the participants. Analysis of the results organized by the aspects of teaching and learning with direct quotations selected from interview responses of the participants regarding each aspect.

Table 6. Ipsative mean score of teacher’s beliefs about teaching and learning aspects

<table>
<thead>
<tr>
<th>Teaching-learning aspects</th>
<th>Belief dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional/Direct transmission</td>
</tr>
<tr>
<td>Teaching strategy /pedagogy</td>
<td>-0.093 (-)</td>
</tr>
<tr>
<td>Teacher role</td>
<td>-0.002 (-)</td>
</tr>
<tr>
<td>Student role</td>
<td>0.448 (+)</td>
</tr>
<tr>
<td>Classroom organization</td>
<td>0.016 (+)</td>
</tr>
<tr>
<td>Curriculum/ learning content</td>
<td>-0.166 (-)</td>
</tr>
</tbody>
</table>

Note: Positive score values indicate that one set of beliefs receives a relatively stronger support than other

3.1. Teaching strategy/ Pedagogies

The mean score value is positive in modern category of belief dimensions (Table 6). It indicated that the teacher participants’ belief regarding pedagogy supported modern approach of teaching. They acknowledged learners as the heart of their instruction generally called student-centered learning. The survey results corroborate with interview findings. Five participants’ teachers out of ten expressed their ideas of teaching by using the terms guiding, encouraging, helping students to discuss, to make interpretation, to express their feeling, to make meaning. The following
statements quoted directly from the interview:

...guiding student to make meaning of the content is the best way of teaching... (P3)

...student will learn by themselves, I encouraging them to discuss with each other for developing a good idea… (P5)

...best way of teaching according to me is to help student to make understanding... (P7& P8)

...allowing student to express their feelings is my way of best teaching... (P9)

On the other hand, five participants (1, 2, 4, 6, & 10) beliefs align to direct transmission belief of teaching. They could not recognize students as the central part of teaching. According to them, best way of teaching is giving student clear information; presenting scientific facts from credible sources by the teachers. The following statements quoted directly from the interview:

...students will make mistake if they are not giving clear and accurate information which ultimately attributed poor result... (P1, P4, & P6)

...presenting the scientific facts from suitable sources (e.g. books & references) is the best way of teaching… (P2 & P10)

3.2. Teachers’ role

The participants teachers’ belief regarding teachers’ role support contemporary dimension of beliefs index (Table 6). The positive score value of the respondents designate that teacher’s role is to monitor student understanding and guide discussion so that all students have opportunities to express their understandings in language and engage in activities such as clarifying, elaborating, justifying, and evaluating alternative points of view (Tobin et al.,1994). This finding was confirmed by the results of interview. In responding to the teachers role during interview, five of the teacher participants (P3, P5, P7, P8 & P9), accredited in teachers’ mediating role (Table 7). In stating their views regarding teachers role, the participants applied the terms allow student to interact with peers and to learn by themselves; paying attention to students’ prior knowledge; let student discuss to come up with a solution. The following statements quoted directly from the interview:

…I believe that if teachers allow student to interact they will gain authentic experiences… (P3 & P7)

…according to me teachers role should be allowing student to learn by themselves…(P5)

...Students solve their own problems if teachers allow them to discuss…teacher will provide information if they require… (P8)

… teachers role is to check student prior knowledge to make an authentic
context of teaching environment … (P9)

In contrast, participants (1, 2, 4, 6 & 10) beliefs regarding teachers’ role parallel to those of traditional dimension where teachers’ role is to dispense accurate knowledge; correct way to solve problem; set learning goal, and check student knowledge by searching predetermined response (Fosnot, 1996). The following statements quoted directly from the interview:

…teachers main role is to communicate knowledge from textbooks and other reference books because students have to pass the exam… (P1 & P4).

…if teachers make mistakes certainly it will do harm to students, so teachers main responsibility is to transfer true and authentic knowledge… (P2 & P6)

… science is full of problems so I believe teachers should demonstrate accurate way to solve problems… (P10)

Teach ers in this category believed in students’ mastery learning (table 7). According to them, best ways of learning are finding the right answer; drilling; repeating until mastery; hard working on practicing class work.

3.3. Students’ role

The corresponding positive value of student role in traditional belief category (Table 6) indicated that the respondents of the study did not give credibility to students as discoverer of knowledge rather thought as passive recipient of the information, listening to explanation from teachers, taking notes, raising questions only occasion. This finding was validated by the results of interview (table 7). All the participants except three (P3, P5 & P7) accredited students as passive learners. They believed that student responsibilities are to cope what teachers do; passive listening; memorizing scientific facts and listening teachers talk carefully. The following statements quoted directly from the interview:

…students have to follow the teachers, they should listen carefully what teacher talk and should cope what teachers do… (P1, P4, P9 & P10)

… the information (knowledge) given by the teacher is very important for the student to pass the exam so student should take the notes while teacher talk…(P2 & P6)

…to achieve a good result student should memorizes scientific theory, definition, process, concepts (facts)... (P8)

Conversely, three of the participants recognized students as independent learners (table 7). They ascribed students as a creator of knowledge as an autonomous explorer. The following statements quoted directly from the interview:

…students are the seeker of knowledge, they will find out their way to reach the goal, teachers just create that atmosphere… (P3 & P7)

… concrete learning occurs when student learn something by themselves not following the teachers… (P5)
3.4. Classroom organization

The subsequent positive value of classroom organization in traditional belief category (Table 6) denoted that participants of the study did not support the contemporary classroom scenario rather a quiet and calm classroom state was appealing to perform whole class instruction and routine activities. In responding to the ideal setting of teaching during interview, six of the participants’ teachers supported the notion similar to those of traditional beliefs (table 7). The following statements quoted directly from the interview:

- ...students need to listen teachers talk carefully so a conducive teaching environment is very necessary… (P1 & P4)
- …classroom must be calm and quite otherwise student cannot listen what teacher saying and may miss the steps of scientific process… (P2 & P10)
- … the whole class should be under teachers control because otherwise student cannot follow teacher’s lecture…(P6)
- ... teachers’ lecture is very important for student, so noise free environment is necessary for lecturing…(P10)

On the other hand, four of the participants’ belief regarding classroom organization analogous to modern setting where teachers offer a variety of avenues for exploration various routes of approaches (Fosnot, 1996) and where unexpected classroom happening is anticipated by the teachers. The following statements quoted directly from the interview:

- …Classroom is a place of teacher-student discussion, student-student discussion, through this discussion learning takes place... there is no single way of teaching…(P3& P7)
- … a risk-free atmosphere is very necessary especially in sciences so that student can share their ideas and join various activities without hesitating…(P8)

3.5. Curriculum/learning content

The related positive value of the curriculum aspect in modern belief category (Table 6) indicated that respondents of the study endorsed more interactive and dynamic curriculum. Dynamic view of curriculum is like as matrix of ideas to be explored over a period time than as road map (Prawat, 1992) which is relaxed and flexible in nature and focusing on thinking and understanding by problem solving or inquiry.

During interview, respondent were asked about reasons for teaching facts vs. development of thinking and reasoning, only three of them support this notion of dynamic curriculum (Table, 7).
## Table 7. Summary of teachers’ beliefs

<table>
<thead>
<tr>
<th>Participants (P)</th>
<th>Best way of Teaching</th>
<th>Ideal setting for teaching</th>
<th>Teachers’ role</th>
<th>Best way of learning</th>
<th>Students’ role</th>
<th>Reason for focusing (facts/thinking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 1</td>
<td>giving student clear information</td>
<td>conducive environment instructing whole class</td>
<td>communicating predetermine mine knowledge</td>
<td>finding the right answer</td>
<td>coping what teachers do.</td>
<td>passing the exam</td>
</tr>
<tr>
<td>P2</td>
<td>presenting the scientific facts from credible sources</td>
<td>calm and quite classroom conveying the knowledge</td>
<td>Transfering true knowledge</td>
<td>listening teachers talk carefully</td>
<td>passive listening</td>
<td>promoting next grade</td>
</tr>
<tr>
<td>P3</td>
<td>guiding student to make meaning giving</td>
<td>no specific setting, various ways of teaching</td>
<td>interacting with student</td>
<td>coping with authentic experience</td>
<td>seeker of knowledge</td>
<td>generating new ideas</td>
</tr>
<tr>
<td>P4</td>
<td>giving student clear information</td>
<td>conducive environment instructing whole class</td>
<td>inculcating knowledge of scientific truth</td>
<td>hard working on practicing class work</td>
<td>listening teacher talk carefully</td>
<td>completing syllabus exam</td>
</tr>
<tr>
<td>P5</td>
<td>encouraging discussion</td>
<td>different ways of teaching; peer or group discussion</td>
<td>allow student learn by themselves</td>
<td>discuss with peers and teachers</td>
<td>independent learning</td>
<td>expressing various ways</td>
</tr>
<tr>
<td>P6</td>
<td>giving accurate explanation</td>
<td>well managed classroom whole class instruction</td>
<td>transferring authentic knowledge</td>
<td>drilling exercise</td>
<td>recipient of information</td>
<td>cutting good score of science</td>
</tr>
<tr>
<td>P7</td>
<td>helping student to make interpretation</td>
<td>various ways of teaching</td>
<td>interacting with student</td>
<td>coping with authentic experience</td>
<td>seeker of knowledge</td>
<td>generating new ideas</td>
</tr>
<tr>
<td>P8</td>
<td>helping student to make understanding</td>
<td>risk free environment for expressing ideas</td>
<td>let student discuss to come up with a solution</td>
<td>exploring authentic experiences</td>
<td>memorizing scientific facts</td>
<td>passing exam, promotion</td>
</tr>
<tr>
<td>P9</td>
<td>allowing noiseless</td>
<td>paying</td>
<td>repeating</td>
<td>listening</td>
<td>completing</td>
<td></td>
</tr>
</tbody>
</table>

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The following statements quoted directly from the interview:

...if students were given facts during teaching they just memorize but if they are given opportunities to develop thinking they will generate new ideas which is very necessary... (P3 & P7)

... if students develop their think ability on the topic delivered by the teachers they can express their ideas in various ways...(P5)

On the contrary, seven of the participants’ beliefs aligned with popular view of the curriculum. Popular view (Prawat, 1992) of the curriculum thought as a daily course to be run that consists of preset means (i.e., a certain material to cover), planned and well sequenced structured, a finite body of predetermined knowledge (i.e., a discrete set of skill or competencies); fixed and rigid in nature. The reasons for choosing this static view as stated by the participants below:

...students should learn scientific facts because otherwise they will not pass the exam... (P1, P8 & P10)

...if teacher do not bring in the whole syllabus consisting of facts, student may miss some important knowledge... (P4 & P9)

...if teachers do not focus on teaching facts student will not pass and will not be promoted to next grade... (P2 & P8)

### 3.6. Influencing factors of teachers’ belief

Table 8 shows that teachers’ beliefs vary in terms of age, higher education, teaching experiences and trainings but remained constant in terms of sex. The participants whose age ranging between under 25 up to 49, hold traditional and inconsistent beliefs. On other hand, those who belong to the age ranging between 50 to 60 and above had contemporary as well as consistent belief in various aspects of teaching and learning. Participants having bachelor degree, possessed traditional belief in different aspects of teaching and learning but those have master degree and above, apprehended modern belief.

Similar trend was found in case of teaching experiences. Participants of the study having teaching experience 1st year to 15 years had traditional belief but those with
experience between 16 years to 20 years above, possessed contemporary beliefs.

Table 8. Ipsative mean score of teachers by sex, age, education, Teaching experience and Training

<table>
<thead>
<tr>
<th>Background factor</th>
<th>Sub-category</th>
<th>Belief dimensions</th>
<th>Direct transmission belief about Teaching–learning aspects</th>
<th>Modern belief about Teaching–learning aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Teaching style/ Pedagogy</td>
<td>Teacher role</td>
<td>Student role</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>-0.122</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>-0.040</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Age</td>
<td>under 25</td>
<td>-0.167</td>
<td>0.16</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>25-29</td>
<td>-0.014</td>
<td>0.09</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>30-39</td>
<td>-0.090</td>
<td>0.05</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>40-49</td>
<td>-0.149</td>
<td>0.00</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>-0.050</td>
<td>0.12</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>-0.250</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>Education</td>
<td>Bachelor</td>
<td>-0.081</td>
<td>0.00</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>-0.093</td>
<td>0.00</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>above</td>
<td>-0.250</td>
<td>0.25</td>
<td>0.33</td>
</tr>
</tbody>
</table>
In-service training was found as an influential factor of teachers’ belief. The participant of the study shown that participants who received CPD and TQI training held contemporaneous beliefs whereas the participants with the training B.Ed and SBC, possessed traditional beliefs in various aspect of teaching and learning.

Interview findings (table 8) were parallel to this. It was found that participants those have long teaching experience and much training, hold modern beliefs. It was also found that, B.Ed training (the basic required training for secondary teachers) did not have influence in teacher’s beliefs as like as sex. In this study, discipline/subject was not found as an influential agent in teaches’ belief.
4. Discussion & Conclusion

The results of the study have revealed that science teachers’ belief regarding teaching and learning did not partition within a particular belief dimension. The findings are parallel to the previous research conducted by Levitt, (2002); Tsai (2002); and Koballa, et al. (2000). Teachers possessed direct transmission (traditional) belief regarding student role and classroom organization aspects of teaching and learning. On the other hand, the participants’ support of modern belief on teacher role, curriculum, and teaching style aspects of teaching and learning are stronger than that direct transmission belief.

The most encouraging result of the present study is that the participants are aware of the contemporary teaching strategies (table 6). They believed that pupils are the heart of the instructions generally called learner–centered teaching and learning. Student-centered learning requires students to set their own goal, determine resources, and activities that will help them meet those goals (Jonassen, 2000). This result coincides with other research performed by Levitt (2002). He concluded that teachers believe that the teaching and learning of science should be student centered. It is assured that the secondary schools’ teachers of Bangladesh have gained this notion of modern teaching from the in-service training “especially TQI training”. It is evident that teachers who received TQI training along with short term overseas training, and CPD professed modern beliefs about teaching and learning (table 7 & 8).

Concerning the teachers’ role aspect of teaching and learning, the participants’ belief aligned with modern notion about teacher’s responsibilities (table 6). Belief in the role of teacher as facilitators, guide, provocateur, friends and so on (Tobin, et al., 1994). This result is similar with the result of Levitt (2002) and Tsai (2002). Interview result, however, revealed that participants had traditional belief that the role of teachers is to dispense facts or to transmit a body of knowledge (table 7). It is vivid that teachers, who had least teaching experience, received a few or no training and also low education possessed traditional beliefs (table 8). It is found that teaching experience shows a significant effect on the vast majority of beliefs (Brousseau, et al., 1998, OECD, 2009).

An important finding of this research is that teachers were incoherent in expressing their beliefs to a particular aspect of teaching and learning to its associated aspects. For example, most of the teachers in this study believed in teachers mediating role that is supposed to monitor student understanding and guide discussion so that all student have opportunities to express their understanding in language and engage in activities such as clarifying, elaborating, justifying and evaluating alternative points of view (Tobin, et al, 1994). However, participant teachers did not believe in students’ autonomous behavior as independent knowledge discoverer rather thought as passive recipients of the information, listening to explanation from teachers and taking notes (Prawat, 1992; Fosnot, 1996). It is evident that when teachers provide student with opportunities to feel supported, challenged, and autonomous in the classroom, student’ motivation increase. Conversely, when teachers predominate role in the classroom is to transmit knowledge as an authority students’ intrinsic motivation decreases (Wetzel, 1998). It can be speculated that low think ability and low interest of science of Bangladeshi secondary science student attributed by passive recipients of information. Researchers and practitioners agree that meaningful learning occurs best when students are active participants, not passive recipients.
A modern view of learning rejects previous ideas that pictured learners as vessels into which teachers could pour new ideas and information—straight from the teachers’ brain to the students’ brain, completely intact. Instead, it views learners having complex networks of understanding that they have developed from their experiences. As they encounter new experience through their senses, they attempt to fit these into their existence networks. However, good teachers can provide environments that support learners in the process of establishing these connections and making sense of what they experience (Dawkins, 2004).

The participants’ belief about classroom organization were corresponding with the beliefs those of traditional ones where a quite classroom state was appealing to perform whole class instruction and routine activities (Table 6 & 7). The participant teachers of the study tried to avoid unexpected happening in the classroom through this mechanical teaching. It is said that teachers who are insecure in their knowledge of science can find the uncomplicated transmission of knowledge attractive (Osborne and Freyberg, 1985). Transmissive teaching avoids discussion (since learners lack knowledge worthy of consideration) and interactions which might reveal teachers’ uncertain knowledge and so alter power relationships in their classroom (Malcolm Carr, et al., 1994).

Concerning the curriculum/learning content aspect of teaching and learning, the participants’ beliefs analogous to those of modern belief (Table 6) that is dynamic view of curriculum (Prawat, 1992) which is relaxed and flexible like as a matrix of ideas to be explored over a period of time than as road map, focusing on thinking and understanding by problem solving or inquiry. Interview results, on the other hand, shown that most of the teachers had popular view of curriculum (Table 7) which is a daily course to be run consisted of preset means, planned and well sequenced structured (Prawat, 1992). This finding is similar to the findings of Tobin, et al. (1994). While interviewing, most of the teachers of the study stated that the reason for teaching facts because students have to cut good scores to promote next grade or passing the exam. Although science teachers of Bangladesh have modern beliefs about curriculum aspect of teaching and learning but due to the constraint (i.e. social expectations) they could not translate it into real culture. When constraints act as myths for culture (i.e. time, scarce resources, control, social expectations), they may suppress any changes considered, even when teachers are strongly committed to personal change (Tobin, et al., 1992).

Most promising and encouraging finding of the study was that background factor, for example, sex did not have influence on teachers’ belief (Table 8 & 7). This finding is in contrast with the previous research. For example, OECD (2009) found that female teachers endorse direct transmission beliefs less strongly than the male teachers. However, other background factors (i.e. teaching experiences, subject taught, and in-service trainings) were found influential on teachers’ beliefs.

This is not surprising that Bangladeshi secondary science teachers have variegated beliefs regarding teaching and learning aspects because like other countries’ teachers (see Tobin et al, 2004), they do not have the opportunities to inquire their own epistemological beliefs. As stated by Taylor (1998) that epistemological self-inquiry involves reflecting critically on the myths that frame one’s own pedagogy, particularly the framing assumptions which shape and are shaped by the daily routine enactment of classroom roles. In addition to that
constraints are the major obstacles to change in teachers in line with modern beliefs of teaching and learning.

Part of the solution of this state of beliefs is (Taylor, 1998) to deconstructing the hegemony of modernist science is for science education to empower teachers with rich understandings of the historical and cultural contingency of scientific and mathematical ideas and methods. Until teachers become aware of the mythical nature of modernist science, they are likely to remain intellectually and emotionally unprepared to consider seriously the prospects of engaging their students in existentially challenging modernist perspectives.

Since any change in pedagogy can happen only with a corresponding change in teachers’ beliefs about the appropriateness of an innovation (Wetzel, 2004), therefore, this study suggests that a further study is needed to explore the links between teachers’ beliefs and practices in an ideal classroom setting to understand whether their beliefs are really reflected in actual practices or not.

References


Fulton, Kathleen L. (1999). How teachers’ beliefs about teaching and learning are reflected in their use of technology: Case studies from urban middle schools. Thesis submitted to the Faculty of the Graduate School of the University of Maryland, College Park in partial fulfillment of the requirements for the degree of Master of Arts.


Appendix A

Questionnaire items according to teaching and learning aspects.

<table>
<thead>
<tr>
<th>Teaching-learning aspects</th>
<th>Item statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching strategies/pedagogy</td>
<td>1T) Effective/good teachers demonstrate the correct way to solve a problem.</td>
</tr>
<tr>
<td></td>
<td>2C) Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved.</td>
</tr>
<tr>
<td>Teacher role</td>
<td>3C) My role as a teacher is to facilitate students’ own inquiry</td>
</tr>
<tr>
<td></td>
<td>4T) Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly.</td>
</tr>
<tr>
<td>Student role</td>
<td>5C) I ask my students to suggest or to help plan classroom activities or topic.</td>
</tr>
<tr>
<td></td>
<td>6T) It is better when the teacher – not the student – decides what activities are to be done.</td>
</tr>
<tr>
<td>Classroom organization</td>
<td>7C) Students learn best by finding solutions to problems on their own through working in groups</td>
</tr>
<tr>
<td></td>
<td>8T) To accomplish a whole class assignment a quiet classroom is generally needed.</td>
</tr>
<tr>
<td>Learning content (curriculum)</td>
<td>9T) How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary.</td>
</tr>
<tr>
<td></td>
<td>10C) Thinking and reasoning processes are more important than specific curriculum content.</td>
</tr>
</tbody>
</table>

T: Indicates statements measuring traditional beliefs, C: Indicates contemporary / modern beliefs
Appendix B

Interview Schedule for science teachers

Demographic and Background information
Take note of the following
- Date: __________________________
- Time: __________________________
- Place: __________________________
- Interviewee’s name: __________________________
- Highest educational background: __________________________
- Teaching experience: __________________________
- Subject taught: __________________________
- In-service training: __________________________

Section A
- My Name is Muhammad Nur-E-Alam Siddiquee, I am PhD student at the graduate school for International Development and Cooperation, Hiroshima University, Japan. Holding ID no. D114545. The title of my research is: SCIENCE TEACHER’S BELIEFS AND ACTUAL PRACTICES ON TEACHING AND LEARNING AT SECONDARY SCHOOLS IN BANGLADESH.
- The purpose of the study is to illustrate the science teachers’ beliefs on teaching and learning in Bangladesh.
- All information gathered through this interview will be used exclusively for the purpose of research and anonymity of respondents will firmly be ensured. You are guaranteed that neither you, this school nor any of its personnel will be identified in any report of the results of the study.

Section B
1. In which approach or strategy do you think that science should be taught?
2. Could you describe what an ideal science teaching environment would look like?
3. What do you think teachers should do for effective learning?
4. What are the best ways to learn science? Explain your ideas.
5. What do you think about responsibilities of student when learning science?
6. What should teacher focus on teaching “presenting facts (definition, theory, process, concepts, etc.) or students’ individual development of thinking and reasoning”? Please explain your idea/s with reasoning.

Thank You Very Much for your nice Cooperation!!!!!!