

## **Biology Teachers' Pedagogical Beliefs and Practices at Secondary School Level in Punjab**

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### **ABSTRACT**

The purpose of this study was to find out "Biological teachers' Pedagogical believes and practices at the secondary school level". The population for the present study is Biology teachers of urban and rural areas that are working in school Education Department of District Lahore. The sample of the study was selected by random sampling and consists of 300 biology teachers. Researchers also observed about 30 classes of these teachers. Random sampling technique was used to select the sample of the study. To measure the biology teachers' pedagogical beliefs and practices, a questionnaire was developed by the researcher. The copies of the questionnaire were distributed among the sampled teachers selected from clusters schools of population. To measure the practices of Biology teachers, researchers observed the 30 classes of these biology teachers. Data analysis was done through SPSS. Mean, standard deviation and t-test were applied for data analysis. After Analysis of data, it was found and concluded that there was Biology teacher have a moderately firm belief about the liking of biology subject. Biology teachers beliefs on constructivist pedagogies are also moderately firm. They have moderately firm beliefs on traditional pedagogies as compared to constructivist pedagogies. Female Biology teachers have more strong pedagogical beliefs as compared to male teachers Biology teachers' practices for teaching biology are predominantly traditional. However, practices of constructivist pedagogies are rare. It is recommended that male Biology Teachers ought to be given proper time in their classrooms. They should be given proper training to shape their practices according to their beliefs. Proper supervision and monitoring mechanism will be more helpful for this purpose.

**Key Words:** *Pedagogy, Pedagogical Believes, Teaching Practices*

### **Introduction**

Beliefs are emotional constructs which lead human decision making, behaviours and professional practices. Beliefs may be rooted in different theoretical views which have their roots in different epistemologies and learning theories. Teachers' educational beliefs are generally categorized into two streams i.e. traditional pedagogies also called transmissionist rooted in behaviourist and cognitivist traditions and constructivist rooted in constructivism (Buaraphan, 2011). According to Floweday & Schraw, (2000) beliefs shape and improve a person's value system that helps in determining performances patterns. Individual teacher's beliefs are strong indicators of his/her

instructional classroom practices. Khader (2012) defined classroom practices as a set of teaching strategies and methods of instruction employed in the classroom. Classroom practices also include collaboration between teacher and student aimed at cognitive development of students and achieving desired learning outcomes. Beliefs can be assumed as guiding principles teachers hold to be true that support as lenses through which new experiences can be understood. When people believe something is true, they perceive information supporting that belief. What teachers do in the classroom is supposed to be governed by what they believe, and these beliefs often serve to act as a filter through which teaching judgments and decisions are made (Pajares,

1992; Cantu, 2001). Mihaela & Oana (2015) were of the view, that Educational beliefs about professional individuality affect instructional behaviour. It is the start of the educational process and application of definite methods by teachers. According to Nespor (1987) teachers may have similar scientific knowledge, they are likely to teach in different ways because teachers' beliefs are more powerful than their knowledge to influence the way in which they teach. The discussion about the relationship between knowledge, beliefs and practices show disagreement about whether knowledge makes beliefs or beliefs make practices. Calderhead (1996) summarized beliefs related to teaching and learning. He placed teachers' beliefs into two classes by arguing that teaching as a process of knowledge transmission, while others view as a process of developing social relationships. In contrast to the transmission, the constructivist view is being emphasized more for teaching and learning of science. The constructivist approach in science education is an application that anticipates an active contribution of students in the creation of knowledge and not the simple personal reconstruction of earlier explained knowledge provided by the teacher or by the textbook (Gil-Pérez et al., 2002). Teachers' beliefs, practices and attitudes are significant for understanding and refining educational processes. They are strictly connected to teachers' approaches for managing the challenges in their daily professional practices and to their general well-being. They create students' learning atmosphere and effect student passion and achievement (OECD 2009). Chapoo, Thathong,& Halim(2014) described that the capacity of experienced teachers enables the students to construct

knowledge. It depends heavily on the tactful blending of content and pedagogy, which is conceptualized as pedagogical content knowledge (PCK). A very much prepared and inventive instructor is one who can utilize the accessible assets and even can educate his/her students without books (UNESCO, 2006). Today's studies in the area of pedagogy essentially concentrate on four distinct viewpoints the instructors' expert information, their inspiration, their capacities in self-regulation, and their states of mind/convictions (Baumert and Kunter, 2013). Though numerous studies are conducted in the area of instructors' expert information that includes educators' content learning, pedagogical content knowledge and pedagogical knowledge. There are studies on instructors' states of mind and convictions. What's more, even fewer studies focus on the subject of how these states of mind and convictions affect instructors' instructional conduct or understudies' result. Baumert et al., (2010) in their study broke down the impact of every one of the four measurements (information, inspiration, self-regulation, convictions) on educators' instructional conduct and prospective teachers' result in science training. Instructors' beliefs ought to be considered, keeping in mind the end goal to understand and enhance instructive procedures (OECD, 2009). Although most educators have received similar preparation amid their pre-service training, their practices in the classroom change (Uzuntiryaki and Boz,2007) and in their pedagogical comprehension, and additionally their presentation routines and classroom practices (Bryan, 2003) Instructional practices intensely rely upon instructors and their expert capacity of educating the students (Campbell,

McNamara, and Gilroy, 2004). Tsai (2002) stated that the beliefs of several teachers, who have outdated ideas of teaching and learning science, and the nature of science, may originate from the problem of their own school science experience. Science classes, laboratory exercises, and relevant activities in teacher education programs may be protected from these traditional views. There is a strong relationship between the science teachers' experiences of teaching and their developing pedagogies. The dynamic nature of teachers' teaching and learning beliefs are affected by their personal, social, cultural, historical, and contextual influences. Science instructors' pedagogical beliefs can be categorized into three types on the basis of learning theories and epistemologies. Similarly, instructors can be grouped into three types i.e. the Scientific-Innovative, the Pedagogical-Innovative, and the Scientific-Conventional (Neuhaus & Vogt, 2005). College biology instructors have been called upon to transform their teaching to improve student outcomes (American Association for the Advancement of Science, 2011), and to contribute to the goal of producing one million more highly qualified graduates in science, technology, engineering, and math (STEM; President's Council of Advisors on Science and Technology, 2012). Mansour (2009) argued that there is a collaborative connection between knowledge and beliefs. The experienced teachers' beliefs act as an information controller and urgency categorizer. In the collaborations between knowledge and beliefs. Beliefs control the attainment of knowledge and knowledge affect the beliefs. Luft & Zhang (2014) found in their study that over time new teachers are more influenced by their school cultures than by their induction

programs. However, from the data, it is evident that beliefs and practices are flexible, but that they are impacted by different factors. Harcarik (2009) found a relationship between fifth-grade teachers' social studies knowledge and beliefs and their relationship to classroom practices. Wang (2006) studied in China about teachers' beliefs in English language teaching learning and their classroom practice. Richardson, Andres, Tidwell and Lloyd (1991) found the relationship between teachers' beliefs and practices in reading comprehension classes of various grades using belief interview technique and observing their classroom practice. Chou (2008) investigated a study on beliefs about teaching reading among university teachers and found that there was no significant relationship between the participants' beliefs and their classroom practices. Shun (2008) also investigated in Singapore about teachers' beliefs and their relations to instructional methods and found that there was not much variance in teachers' beliefs, and the use of instructional method. Keeping in view the role of pedagogical beliefs in teaching and learning process present study was devised to solicit biology teachers' pedagogical beliefs and teaching practices in the Pakistani context.

### **Statement of the Problem**

Research studies exhibit a relationship between teachers' pedagogical beliefs and their teaching practices. Pedagogical beliefs can be determinants of the practices of teachers. The present study aimed to explore the "Biological teachers Pedagogical beliefs and practices at the secondary school level".

### **Objectives of the Study**

Followings were the main objectives of the study:

1. To investigate the pedagogical believes of biology teachers
2. To compare pedagogical beliefs of male and female Biology teachers.
3. To gather information about teaching practice in the biology class

**Research Questions**

Followings were the main research questions of the study

1. What are the biology teachers' pedagogical beliefs about teaching of biology?
2. What is the difference between the pedagogical beliefs of male and female teachers?
3. What are biology teachers' actual classroom practices in teaching biology?

**Significance of the Study**

1. It is hoped that this study provides a clear understanding of teachers how their beliefs influence their classroom practices. This may prompt them to create interest in the professional development to enhance their knowledge or may make them more aware of the effect of those beliefs on their pedagogical decisions .and consequently contribute in improving the achievements of their students.
2. This study may provide researchers with a framework for identifying the elements that contain the system of teachers' beliefs. This will also provide

knowledge, skills and tools for data collection through the literature review.

3. This research may provide findings and a tool for officials, educators, teachers and other workers in studying the classroom behaviour to evaluate the teachers' beliefs and their practices in a more comprehensive way than the conventional methods.
4. This study will also contribute to the Educational institutions regarding the common pedagogical beliefs in teaching Biology among teachers and their relationship with classroom practices.

**Delimitation of the Study**

1. This study was delimited to only public secondary schools of District Lahore only.
2. Only 300 teachers of Biology were selected by multistage sampling technique due to time and financial constraints.

**Population and Sample of Study**

The populations for the present study were all Biology teachers from 331 schools that were working in school Education Department of District Lahore only. Sample of the study was chosen District Lahore that was consist Tehsil City and Tehsil Cantt only. The sample of the study consists of 300 biology teachers. Researchers also observe 30 classes of these teachers.

Table 1

	Boys schools	Girls schools	Total schools
Population	152	179	331
Sample (school)	91 (60%)	98 (55%)	190 (57%)
Sampled Teachers	127	173	300

**Instruments**

To measure the biology teachers Pedagogical believes the researchers

adopted 5 point Likert type questionnaire developed by the Edmunds, Thorpe & Conole (2012). The questionnaire consisted

of four parts (A, B, C & D). Part A consisted of demographics part B comprised of 11 statements about beliefs part C has 16 statements about Constructivist Pedagogical Beliefs and part D consisted of 13 statements about the traditional pedagogical belief. The questionnaire consisted of 40 statements. The researchers distributed 327 to Biology teachers randomly. The Researcher also prepared a checklist for observation of classroom practices of Biology teachers. This checklist has the space for entries of date, teacher name, class, duration of the period, observer name, school name, observation time start and ending time of the class. This checklist of classroom observations consists of 22 Items about classroom environment for learning instructional methods of Biology teachers and involvement /responsiveness student in learning.

**Table No 2**

*Mean Response values for Biology Subject Liking Beliefs*

<b>Belief Statements</b>	<b>Mean</b>	<b>SD</b>
Biology is an interesting subject.	4.14	1.16
It is useful to learn biology as subject.	3.92	1.03
Biology is a subject which helps to learn about daily life.	3.92	1.09
I as biology teacher interested to learn modern topics of biology to refresh my knowledge	3.89	1.27
Students are keen to learn biology as a subject.	3.82	1.14
It is difficult to teach biology subject.	3.81	1.15
To go to biology laboratory for practical work is satisfying for me.	3.78	1.24
I like to teach biology as subject.	3.73	1.17
I take interest in preparing biology lecture before classroom practices	3.70	1.23
To teach biology subject give me satisfaction	3.52	1.39
It is difficult to teach biology without A/V aids.	3.51	1.44

Mean response values for beliefs related to liking of the subject ranged from 3.51 to 4.14. Table presents beliefs statements arranged in descending order of respective mean response values. Most firm belief of biology teachers is that biology is an

### **Data Collection**

Data was collected from all participants during the academic year 2016-2017. Before distributing all questionnaires, the researcher introduced the topic of the research to the participants. The data were collected by the researcher himself. Before data collection, the heads of the sample schools were contacted to obtain informed consent. The instrument was administered among the sampled teachers. The participants were guided to tick the right option of each statement after understanding it. The questionnaires were collected back after some time.

### **Data Analysis and Findings**

The following section implies an analysis of data. There were 41 Likert type items in the questionnaire that were used to obtain data from teachers. Data were analyzed in SPSS using t-test, frequencies, percentage and graphs.

interesting subject. They consider biology a useful subject and helpful in understanding about daily life. Biology teachers believe in learning new knowledge of biology. They also believe that students are keen to learn Biology. Teachers also believe that teaching

of biology is not an easy task. Practical work in laboratory is believed to be satisfying by the teachers. Teachers like teaching biology and take interest in preparing lectures for classroom. It was

believed by the teachers that teaching of Biology give them satisfaction but it was relatively less firm belief. Another relatively less firm beliefs was teaching of Biology without audio visual aids.

**Table No 3**

*Mean Response Values for Constructivist Pedagogical Beliefs*

<b>Constructivist Pedagogical Belief Statements</b>	<b>Mean</b>	<b>SD</b>
The ideas of students are important and should be carefully considered.	3.96	1.20
Effective teaching encourages more discussion and hands-on activities for students.	3.88	1.21
Instruction should be flexible enough to accommodate individual differences	3.86	1.09
My role as a teacher is to facilitate students' own inquiry.	3.86	1.22
Different objectives and expectations in learning should be applied to different students.	3.83	1.25
Every child is unique or special and deserves an education tailored to his or her particular needs.	3.79	1.22
Good teachers always make their students feel important.	3.79	1.23
The focus of teaching is to help students construct knowledge from their learning experience instead of through knowledge communication.	3.77	1.16
Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved.	3.76	1.23
In good classrooms, there is a democratic and free atmosphere that stimulates students to think and interact.	3.76	1.37
It is important that a teacher understand the feelings of the students.	3.71	1.25
Students should be given many opportunities to express their ideas.	3.70	1.32
Learning means that students have ample opportunities to explore, discuss, and express their ideas.	3.60	1.19
Students learn best by finding solutions to problems on their own.	3.55	1.30
Thinking and reasoning processes are more important than specific content	3.55	1.27

Mean response values of Biology teachers' beliefs on constructivist pedagogy ranged from 3.55 to 3.96 i.e. greater than 3.5 and less than 4. These beliefs can be termed as moderately positive. Above table presents belief statements according to descending order of respective mean response values. Statement at the top with mean response value of 3.96 indicates most firm beliefs i.e. teachers' consideration for importance of students in the learning process. Biology teachers' next firm belief was about importance of discussion and hands on activities by the students. Teachers believed facilitation as role of teacher. They believed

on individualized instruction to cater individual differences. Teachers believed on facilitation of students' own inquiry. They believed on uniqueness and diversity of students and hence tailoring particular needs of the students. Biology teachers believed on making students feel important. They believed on enabling students to construct their knowledge through experience and interaction. Teachers also believed on problem solving by the students. Teachers believed on democratic stimulating and free environment in the classroom. Biology teachers had moderately positive but relatively less firm

beliefs due to low mean response values on importance of students feeling, giving students opportunities to express ideas,

opportunities for students to explore, discuss and express ideas and learning as problem solving and reasoning process.

**Table No 4**

*Mean Response Values on Traditional Pedagogical Beliefs*

<b>Traditional Pedagogical Belief Statements</b>	<b>Mean</b>	<b>SD</b>
Learning means remembering what the teacher has taught.	4.12	1.06
Good students keep quiet and follow the teacher's instruction in class.	4.02	1.14
How much students learn depends on how much background knowledge they have; that is why teaching facts is so necessary.	4.00	1.20
Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it.	3.99	1.24
Students have to be called on all the time to keep them under control.	3.98	1.10
Learning mainly involves absorbing as much information as possible.	3.97	1.20
Good teaching occurs when there is mostly the teacher talking in the classroom.	3.97	1.32
Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly.	3.96	1.21
During the lesson, it is important to keep students confined to the textbooks and the desks.	3.89	1.17
The traditional/lecture method for teaching is best because it covers more information/ knowledge.	3.83	1.11
Effective/good teachers demonstrate the correct way to solve a problem.	3.82	1.26
Learning to teach simply means practicing the ideas from lecturers without questioning them.	3.70	1.20
Teaching is simply telling, presenting, or explaining the subject matter.	3.68	1.27

Biology teachers' beliefs on traditional pedagogy were found to be more firm with mean response values ranging from 3.68 to 4.12. Biology teachers' most firm belief was found to be, "Learning means remembering what the teacher has taught". "Good student keep quiet and follow teachers' instruction in the classroom" was their second firm belief. Biology teachers strongly believed that background knowledge and teaching of facts was necessary. Biology teachers' moderately positive beliefs with mean response values less than 4 and greater than 3.5 are listed below.

1. Teaching is to provide students with accurate and complete knowledge

rather than encourage them to discover it.

2. Students have to be called on all the time to keep them under control.
3. Learning mainly involves absorbing as much information as possible
4. Good teaching occurs when there is mostly the teacher talking in the classroom.
5. Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly.
6. During the lesson, it is important to keep students confined to the textbooks and the desks.

- 7. The traditional/lecture method for teaching is best because it covers more information/ knowledge.
- 8. Effective/good teachers demonstrate the correct way to solve a problem.
- 9. Learning to teach simply means practicing the ideas from lecturers without questioning them.
- 10. Teaching is simply telling, presenting, or explaining the subject matter

**Table No 5**

*Summary of Independent Sample t-test to compare pedagogical Beliefs*

Dependent Variable	Groups	N	Mean	SD	t-value	Sig.
Biology Subject Liking Beliefs	Male	150	3.75	0.60	1.304	.193
	Female	150	3.84	0.57		
Constructivist pedagogical Beliefs	Male	150	3,72	0.61	1.384	.167
	Female	150	3.81	0.58		
Traditional pedagogical Beliefs	Male	150	3.73	0.68	5.08	.000
	Female	150	4.10	0.56		
Overall pedagogical Beliefs	Male	150	3.73	0.41	3.95	.000
	Female	150	3.91	0.38		

Above table presents summaries of t-tests to find out the significance of difference in beliefs

of male and female teachers. Data shows that t-values were not found to be significant for ‘Biology subject ling beliefs’ and ‘constructivist learning beliefs’. It is therefore concluded that male and female teachers beliefs about liking of subject and constructivist pedagogical beliefs were not significantly different. Summary of t-test reveals that t-values were found to be significant beyond 0.05 level of significance for traditional pedagogical beliefs and overall pedagogical beliefs of male and female teachers. Hence it can be concluded that traditional pedagogical

beliefs and overall pedagogical beliefs of male and female teachers were significantly different. Mean values indicate that female teachers have more firm traditional beliefs and overall beliefs as compared to male teachers traditional pedagogical and overall pedagogical beliefs.

**Interpretation of Observation Results**

The following analysis was done on the basis of class room observations.

**Table No 6**

*Summary of Classroom Observation Showing Cumulative Frequency of Activities over Time*

Classroom activities/Practices	Cumulative Frequency of 30 classroom observations by time						Total	Pedagogy
	1-5 minutes	6-10 minutes	11-15 minutes	16-20 minutes	21-25 minutes	26-30 minutes		
Teacher was teaching and demonstrating from the textbook?	29	29	26	26	29	29	168	Traditional
Teacher is strict in his behavior to students?	28	28	28	28	28	28	168	Traditional



Teacher is not letting students to talk?	28	27	27	27	27	27	163	Traditional
Teacher is transferring information by giving lecture	28	27	26	26	27	27	161	Traditional
Teacher is standing or sitting in front of class?	28	27	27	27	26	25	160	Traditional
Teacher is treating every child in the same way. (No child is special)	22	29	29	29	29	22	160	Traditional
Students were attentive towards teachers' lecture/ demonstration.	25	26	27	27	28	24	157	Traditional
Students are only listening to teacher?	25	24	24	23	24	22	142	Traditional
Teacher was interacting and asking questions from student to student	27	29	22	21	19	21	139	Traditional
Students were making notes during class?	20	21	23	23	23	23	133	Traditional
Teacher was using white or black board	15	19	21	22	20	14	111	Traditional
Teacher is testing background knowledge of students?	24	15	12	5	6	7	69	Traditional
Teacher was providing helping material/ notes to students	7	7	8	8	8	8	46	Traditional
Teacher is taking round of class and involving all students?	2	3	3	3	4	5	20	Constructivist
Teacher was brainstorming to making students to think	2	3	4	4	3	3	19	Constructivist
Teacher is democratic in classroom?	2	3	4	4	3	3	19	Constructivist
Students were discussing about difficult concepts with teacher	2	3	4	4	3	3	19	Constructivist
Students were participating in discussion initiated by teacher?	2	3	4	4	3	3	19	Constructivist
Teacher is giving chance to students to express their ideas?	0	3	4	4	3	3	17	Constructivist
Teacher is asking students to solve the given problem by their own?	0	0	4	4	2	2	12	Constructivist
Students were doing group discussion during class	0	0	0	2	3	3	8	Constructivist

Above table presents summary of 30 classroom observations. Classroom practices were enlisted and occurrences of these activities were recorded over time. Above table shows cumulative frequency of occurrence of each activity in 30 classes. Last column shows total frequency of occurrence of each activity in all observed classes. Classroom activities have been

arranged in descending order of total of cumulative frequencies. This arrangement shows most frequent activities at the top and less frequent activities at the bottom. It can be noticed that classroom activities at the top are traditional rooted in behaviorist pedagogies. Whereas practices rooted in constructivist pedagogies are at the bottom, which means practices of constructivist

pedagogies are not common. Hence it can be conducted that predominant practices of biology teachers are traditional in nature. Constructivist pedagogies are rarely practiced by the Biology teachers.

### Conclusion

Biology teacher have moderately firm belief about liking of biology subject. Biology teachers believes on constructivist pedagogies are also moderately firm. Biology teachers have very firm and moderately firm beliefs on traditional pedagogies. Biology teachers have relatively more firm beliefs on traditional pedagogies as compare to constructivist pedagogies. Biology teachers' practices for teaching biology are predominantly traditional. However practices of constructivist pedagogies are rare. Briefly it can be concluded that 'originations of instructing can be analyzed under two noteworthy classifications of showing practice, conventional and constructivist. The Biology teachers use more traditional practices as compared constructivist pedagogies. However they lean toward the constructivist methods on small scale. The aftereffects of the study have uncovered that science instructors' belief in regards to showing and learning did not segment inside of a specific belief measurement. The discoveries are parallel to the past examination led by Levitt, (2002) and Koballa, et al. (2000). Instructors had direct transmission (customary) belief with

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respect to understudy part and classroom association parts of showing and learning. Then again, the members' backing of present day belief on educator part, educational programs, and showing style parts of showing and learning are more grounded than that immediate transmission belief.

### Recommendations

Following recommendations were made on the base of findings of the study

1. Teachers should be focused on their subjects and they should be trained properly to equip them with latest techniques, methodologies.
2. There should be a special mechanism to monitor and evaluate the class room practices in the subject of Biology.
3. Male Biology Teachers should shape their practices according to constructivist pedagogical beliefs
4. However, considering the findings of research studies in other countries, the consequences of the current research and the finding of the present study, it is suggested & highly recommended that generally Biological teachers Pedagogical believes and practices at secondary school level are very complicated issues and therefore calls for more research studies.

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