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Abstract

The purpose of the single case life history study was to understand a female science teacher's conceptions of the nature of science as explicit in her practice. While this paper highlights these understandings, an additional purpose is to give a detailed account of the process of creating a life history account through more than 13 in-depth interviews. It includes a discussion of what the author calls composite observations where the observations of the teacher and the researcher are presented as a single unified story. Also discussed are ethical issues specific to life history created due to the intimacy created by such a study that required the development of a great deal of trust and rapport.

Keywords

Life History, Nature of Science, Teaching and Learning in Science, and Single Case Study

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Understanding a Pakistani Science Teacher's Practice through a Life History Study

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The purpose of the single case life history study was to understand a female science teacher's conceptions of the nature of science as explicit in her practice. While this paper highlights these understandings, an additional purpose is to give a detailed account of the process of creating a life history account through more than 13 in-depth interviews. It includes a discussion of what the author calls composite observations where the observations of the teacher and the researcher are presented as a single unified story. Also discussed are ethical issues specific to life history created due to the intimacy created by such a study that required the development of a great deal of trust and rapport. Key Words: Life History, Nature of Science, Teaching and Learning in Science, and Single Case Study

Science teachers bring together different kinds of knowledge such as science content knowledge, knowledge *about* science, knowledge of the curriculum, knowledge of the system of education, and most important, pedagogical content knowledge (Shulman, 1986, 1987). Connelly and Clandinin (1988) refer to this complex and interconnected array of knowledge as *personal practical knowledge*. This is not a body of pre-existing knowledge to be brought forth when required. Rather it is transient and situated knowledge which is "experiential, value laden and oriented to practice" (Clandinin, 1986, p. 19). Teachers are involved in making many decisions before, during, and after classroom teaching. The basis on which teachers choose to do one thing rather than another is based on their experiences and what sense they have made of them. Hence, it follows that teachers' life experiences have a deep and abiding effect on the kind of teachers they become. However, what is important is that it is not only professional experiences but all life experiences whether inside or outside the classroom that influence and shape this decision-making process. Hence, it is important to see teachers' lives holistically, particularly when offering professional development because when teacher-educators ask teachers to change their practice, in essence they are asking them to change their lives (Louden, 1991).

This is the rationale for this particular research study. In this paper you meet Munazza Sheikh, a science teacher who works in Karachi Model Secondary School (KMSS) which is a private, afternoon-shift, English-medium and co-educational school for children from middle-income families in Karachi, Pakistan. All teachers, students, administrators and names of institutions mentioned in this paper are pseudonyms to maintain confidentiality. Munazza has completed her Bachelors of Science and at the time of the study she was engaged in completing her Master's in Islamic History. She has had no teacher education as it is not a requirement for private schools in Pakistan.

She has been teaching science for seven years, three of them at KMSS. She was teaching science to grades 7, 8, and 9 and also taught Islamiyat (the study of Islam) to grade 8.

The purpose of this single case life history study was to ascertain a female science teacher's conceptions of the nature of science explicit in her practice in a school in Pakistan, develop an understanding of her practice of teaching science, and determine how the teacher's life history has affected her practice. While teaching science, a teacher projects messages about the nature of science that can be captured by observations and interviews. Furthermore, the manner in which a teacher conceptualizes science for teaching, at least in part, depends on personal life experiences. Hence, I have used the life history method to understand Munazza's practice. I have selected this method because life history allows observation of individuals and how "they act within, respond to, and represent their times and places by presenting both individual life stories and analyses of how social patterns shape those lives" (Thiessen, Bascia, & Goodson, 1996, p. 1). Life histories allow and encourage the researcher to adopt a broader understanding of teaching by providing illustrations of the relationships between various aspects of teachers' lives and their teaching practice, both inside and beyond the classroom. Life history allows the identification of important structural factors and dynamics that are sometimes hidden or not obvious when encountering teachers' stories cut off from their context. Life histories also remind us not to take for granted the ways in which childhood experiences, choosing a teaching career, or in-school and classroom activities influence teachers' curricular choices.

In this paper I will primarily focus on Munazza's teaching practice and the impact of her life history on her science teaching. As part of the study I had long and continuous interaction with her over a 17-month period. I developed a deep insight into her practice of teaching science through 13 in-depth life history interviews and more than 30 observations of her classroom teaching in grades 7 and 8 over a period of six months. I generally observed a whole unit of lesson, from the introduction of the topic to its assessment. All interviews were bilingual in nature and Munazza used both Urdu and English during the interview. Quotations used for this paper have been translated by the author.

I chose to work with a female teacher because I myself have been a female teacher of science. I had laid down a set of criteria for selection of both the school where I would conduct this study and for the female science teacher who would be selected as my research participant. I wanted to work with a teacher who had a first degree in science and had been teaching for three to five years in the school as a designated "science teacher." This would ensure that she had been socialized in the learning and teaching of science both as a student and a teacher in the schools of Pakistan. I wanted the science teacher to have had experience of teaching for at least three to five years in the same school. The purpose was to ensure that the teacher was "fully aware, deeply involved and informed in their particular cultural world" (Spradley, 1979, p. 45). I wanted to observe the teaching of science in grades 6 to 8, hence the teacher must be teaching in these grades. I was looking for a teacher who was not over-committed at work or at home so that she could spare the time to take part in the study (Plummer, 1983). The school could be either from the government or the private sector but should have a cadre of qualified science teachers so that there was a better possibility of obtaining a teacher to volunteer to take part in the study. Moreover, I was interested in

working in a school that catered to the middle or lower-middle class strata of society in Karachi and not a resource rich school for the upper class as these schools usually subscribe to the British standard and advanced qualification system of examination undertaken by universities such as Cambridge University and generally referred to as O and A level system of studies respectively. This system of examination is more expensive and requires the study of curriculum set by the British education system. I was also not interested in working in a school in the *katchi abadis* (shanty-towns) of Karachi. In this case it would be unlikely that I would find an experienced qualified science teacher in such a school. Lastly, I wanted a teacher who worked in a school that was located close to my home and in an area that I deemed safe to visit alone. This was to ensure that I could follow a regular system of visits for interviews and observations.

Based on these criteria I visited four schools; three of them immediately allowed me access to their science teachers with the view to conducting my doctoral study in their school. I talked to 18 science teachers individually and explained the purpose of the study to them and the time and commitment that would be required. A teacher in KMSS, who I knew well, agreed to participate in the study however before an interview could be scheduled she took a job in a university setting. Hence, the Principal of this school recommended the name of Munazza to take part in the study. I did not know her but in talking with her I found that not only was she willing, but also fit the criteria for my research participant. In this way Munazza became a part of my study.

My own experience of learning in a school and later teaching in schools gave Munazza and me a shared basis for understanding each other. Furthermore, in a highly patriarchal society like Pakistan, I was concerned that the power imbalance between the sexes might affect the data generated. Additionally, my study design foreshadowed close interaction and rapport with the teacher; I felt that I could better achieve that with a female teacher rather than a male because of cultural barriers to intermingling of sexes.

Goodson (1992) has characterized life history as “the life located within its historical context” (p. 2) and Bertaux (1981) has defined it as “sociologically read biography” (p. 210). The manner in which I have used life history is more akin to stories or narratives recalling events retrospectively in an individual's life obtained with the help of lengthy interviews (Smith, Kleine, Prunty, & Dwyer, 1986). The data includes interviews with significant others, such as other science teachers in the school and key members of the school administration. It also includes conversations that I had in the classrooms, hallways and the staff room of the school. The heart of the life history method is the special kind of interview process that allows a collaborative construction of the experiences of the interview. The purpose is not to test hypotheses but to develop a better understanding of the experiences of the teacher and the meaning she makes of that experience.

The life history that I present is constructivistic in the sense that the story is not “out there;” it is actively constructed by the author in collaboration with the teacher. The data for the study were generated through interviews, classroom observation and document analysis. The most important part of the life history study is the in-depth interview where the major purpose is to understand the experience of the interviewee and the meaning she makes of that experience (Seidman, 1991). Thirteen interviews spread over six months were carried out in Urdu (the National language of Pakistan) because it would put the teacher at ease and let her talk of her experience comfortably. However, a

lot of English words were used during the conversation particularly when talking about science teaching as science is taught in English in Pakistan. The interviews were then translated verbatim using special software to write the interview transcript in both Urdu and English. From these interviews a chronicle of her life was developed which then led to the selection of stories for portrayal in this paper. I read through all data both from the interviews and observation to select for “portrayal” the sections I felt were pertinent to the research question and used them to piece together my representation of Munazza's life both inside and outside the classroom. The purpose was to find and share the “essence” of her life as I understood it, using her own everyday language and to organize the evidence into a more meaningful form. Once I had obtained her story during an interview, I shared it with her. She did not ask for any explanations or clarifications but suggested some modifications to fill in gaps. The interview data were also analyzed through coding and development of themes which were later collapsed into categories to develop the findings about Munazza’s conception of her practice.

The life history is also topical – that is, it spans Munazza's whole life but the focus is on her science teaching and hence I chose to include stories about her teaching along with incidents about her home life that in my understanding could and did affect her teaching and learning of science. Often decisions about what to include and what to exclude could not be made early in the analysis but had to await a fuller understanding of a particular part of the story which came at a much later stage. For example, understanding of the effect that her brother’s untimely death had on her teaching came to me as a researcher at a much later stage and was included in the report at a later stage. The story that emerged from the more than dozen interviews is also edited to remove repetitions and redundancies. The editing process entailed a *selection* of material. This required subjective decision-making on my part which in turn, has shaped the narrative which I have tried to make as overt and explicit as possible (Riessman, 1993).

In the section below I have given a brief glimpse into Munazza’s life in the form of a story. I have used a number of rhetorical devices to represent the story as obtained from the data. For instance I have used the word “I” to represent Munazza's voice. By letting Munazza tell her life story in her own words I have tried to remove the “middleperson,” and to bring the reader closer to the teacher (Zeller, 1995). One of the criticisms of this rhetorical device is that it masks the researcher's role in the writing. Here, the story told is a story that brings into focus what I have termed, *composite observations*: the story is Munazza's and a very large part of it *is her observations* but it also incorporates my own observations in her class. The technique has allowed documented evidence from several sources to be gathered into a single unified story. To bring into focus Munazza’s teaching practice I constructed composite observations to tell a story about her lesson in the science class. It is a story told through a mosaic or a collage of her actions, views, theories and my observations and interpretations composed of the data both from her life history interviews and the class observations. There is the possibility of mixing up whose story it actually is, if done unmindfully. Hence, I have discussed in detail the rhetorical devices used in developing the narrative account of Munazza’s teaching in the science classroom.

I have also tried to be true to the way Munazza communicates by using verbatim all English words and phrases that she used in her interviews and conversations. The life history obtained through interviews was put into chronological order and sections

germane to her science teaching have been shared in this paper. A section of her life history is also woven into the text, discussing the findings. More than 30 General Science lessons were observed in grades 7 and 8. The observations were scheduled over a period of six months in such a way that I observed the teaching of several whole units of four to five lessons. A chronicle of the series of lessons was developed for analysis and an abridged version of Munazza's teaching of water in class 7 is included in this paper to portray her science teaching.

I collected a number of documents from the field, such as a photocopy of the science notebooks of class 7 students, test papers, a school newsletter, brochures, school magazines and a report card with the passing criteria listed. I scrutinized each document to give me the needed background information. For instance, the teachers constantly referred to the "Jubilee Celebration" in their conversations with me and with each other. The glossy brochure commemorating the 50 years of the Karachi Model School gave me a lot of information about the celebrations and the history and evolution of the school system. In the same way, a copy of a report card that the Principal provided gave me insight into the policies of the school regarding "pass" and "fail."

Ethical issues faced during the study were of two kinds: (a) the general issues of trust, confidentiality and access to the school and the teacher; and (b) the more specific issues pertaining to life history research. The principles of informed consent and confidentiality were followed to the letter as prescribed by university ethical review committee procedures. Informed consent was obtained both from the school principal and the teacher. Single interviews were also undertaken of three other science teachers to understand the general culture and structure of science teaching in the school. Permission from these teachers was obtained once they were identified. One of these teachers was Munazza's sister.

However, the ethical issues pertaining to life history were more complex. I was very concerned about the effect the study would have on Munazza who was not fully aware of how much she was revealing and what effect it might have on her. Measor and Sikes (1992) comment, "It is the intimacy which raises some of the sharpest ethical questions in this kind of research, because the material is intimate, the potential for harm is much greater" (p. 210). However, one of the strengths of life history is that this same intimacy unveils a picture of a life that speaks to the reader and hence the potential for good is also greater. Over the period of the study I established good trust and rapport with Munazza but I was concerned that this would make her reveal more than she might have wanted to. I gave her the opportunity to revisit what she had revealed in the interview by offering to share the whole transcript with her. Knowing that busy teachers might not have the time to read the transcript, I also prepared a one page summary for her of each interview transcript. In addition, before each interview with Munazza, I described briefly what she had shared with me and checked with her regarding whether that is what she meant to say. Aside from correcting one or two factual errors, Munazza agreed with the contents of the interview.

Criteria for Quality

The single participant case study is particularly open to questions regarding the generalizability of research findings because of the highly personalized and subjective

nature of the data. I tried to achieve verisimilitude (Lincoln & Guba, 1985) by trying to write in such a way that the readers can "see for themselves" (Wolcott, 1990, p. 129). I have given a lot of detail, sometimes even mundane details to help the reader see and understand the life of the teacher. I have not tried to take a detached objective perspective; I don't think that it is possible. But I have tried to bring in disciplined subjectivity to my work, taking care that my account is balanced, fair, complete and sensitive (Wolcott). As a part of this effort I shared the chapter of Munazza's life with her and sought her feedback and comments. Another area of concern for a study that relies so heavily on first-person interview accounts is truthfulness and accuracy, in other words: How trustworthy is the data? A number of things were undertaken to ensure the accuracy and trustworthiness of my accounts:

1. I noted the circumstances surrounding the recording and collection of data.
2. I compared statements in one section of the life history with statements in another section for inconsistencies and internal coherence.
3. I compared statements in the life history with data from other source/s within the same setting, such as interviews with other science teachers.

However, the most important facet of the study that can generate trust is complementing retrospective interview data with a prolonged period of observation of Munazza's classroom teaching. I also used fidelity as a criterion for my study. A part of fidelity in research is to select problems that are not only of interest to the academic community but are also of interest to teachers. This means research *for* teaching instead of *on* teaching. This also means involving the teacher as far as possible in the conceptualization of the study and sharing the data collected for her comments and if possible to share and discuss the finding with her. Fidelity means to use the ethic of caring to be "faithful" to the person of the research participant and yet as a responsible researcher honor my commitment to understand the phenomena being studied.

I went into the field with an open mind and tried to find out, "What are the difficulties that Munazza is facing in teaching science?" She was able to articulate the areas where she needed support: in conducting science activities and in better class management. Hence, I used these two lenses to observe her lessons and was able to help her in a limited fashion in both these areas.

Munazza's Story

How Did I Become a Teacher?

When I was a child I would make my siblings sit in front of me and "teach" them. My father bought a full-sized blackboard for me so that I could write on it rather than scribble on the walls while teaching. Despite this early fascination with teaching, teaching school was never my first priority. After my Interscience (equivalent to grade 11-12) there was a long break, so I decided to teach in a school to pass away the long months. Like many other young science students in Pakistan I wanted to become a doctor. I did get into a medical school but that was in rural Sindh, and it meant living

away from home for five years. So, I chose not to go into medicine but to pursue a BSc degree in chemistry and microbiology. My classes in college finished at noon and since I was teaching in an afternoon school I continued to teach throughout my Bachelors.

After completing my BSc I wanted to work in a pathology or microbiology laboratory at least for some time so that I could make use of my knowledge about vaccines, TB tests, cancer, etc., that I had studied in microbiology and biochemistry. However, my father thought that the working environment in laboratories was not good. He believed that teaching was the best and most respectable profession for women and that was what I should take up. Since I liked to teach and already had experience of teaching in schools, I accepted the offer to teach at the Karachi Model Secondary School (KMSS) where my younger sister was already teaching mathematics and science. However, I wanted to, and still want to, work at least for some time in a laboratory to learn more about the practical side of science. I regret not being able to do that. However, do not misunderstand me, I do like to teach. I don't work in the school so that I will meet people or make friends. I come to school because I enjoy teaching. I enjoy being in the classroom. I feel very strongly that if one chooses to teach then one must do it sincerely.

We are eight sisters and one brother. The principal of the school has high regard for the academic accomplishments of our family as my younger sister was an outstanding student of the school and my other siblings who studied at KMSS were also excellent students. She gave me 9th grade chemistry class to teach the same year that I joined the school. This was a great source of satisfaction for me, because at the end of grade 9 students appear for the Secondary Board Examination. But it was also very stressful, because not only was it my first Board class but my younger sister was also studying in the same class. She had a reputation for asking a lot of questions and I made sure that I prepared my lesson thoroughly so that I could answer her questions.

To Teach is to Learn

I found that I learnt much more about my subject while teaching than I ever learnt as a student. As a student I was dependent on the teacher and what she/he thought was important to learn. But as teacher in a coeducation school I find that students, particularly boys, come up with all sorts of questions. I have to be very well-prepared. I dislike it immensely when I cannot answer students' questions. Hence, I read and study from my younger brothers and sister's college and university textbooks so that I am thoroughly prepared for the lesson. I do not think the purpose of teaching is only to complete the course, but the purpose is to teach in a way that students get good marks. This will enable them to get admission in good colleges and get into good professions such as engineering.

In KMSS, we teachers are not expected to make formal lesson plans. In some other schools, such as the Karachi Academy where I taught before I came to KMSS, there was an expectation that teachers will make formal lesson plans before teaching the lessons. All kinds of teaching materials from a demonstration activity to worksheets had to be planned ahead of time. For this purpose Saturday was set-aside for teachers to do their planning and preparation materials for teaching. This was particularly good for me,

as I was teaching as well as studying for my BSc degree. I did all my lesson preparation on Saturdays and spent the weekdays studying.

The Karachi Academy is the school where I *really learnt* to teach. I got a basic understanding of what it is to teach from this school. The Head of the Science Department was a very competent science teacher and an excellent supervisor. She observed my class and made a diagram to show me the distribution of my questions to the students. She helped me in planning the lesson and explained to me that activities should not be for the benefit of the few children sitting in the front. Another science teacher in the school, Miss Surraiya, too was very helpful. If I had difficulties, I would go to these two people. However, when my sister quit her job at Karachi Academy to continue her studies I also quit the school, stayed home for a while but then joined KMSS.

At present, even though I do not prepare lesson plans, I do make a “mental plan.” The night before, I look at the lesson that I have to teach the next day. When thinking about a lesson I am going to teach, I usually do not have a particular approach or teaching strategy in mind. I have no training in teaching in the form of a degree or diploma. When I teach, I keep in mind the way I was taught. But very often I teach in a way that I was *not* taught. Let me explain. When I was studying in school, my science teacher did not show or explain to us anything with the help of activities. She would read from the text and give oral explanations, we as pupils were expected to mark the correct answers in the textbook to questions given at the end of the chapter and memorize them. I often did not understand what I was memorizing. I would do some of the activities illustrated in the science textbook with my sister at home. It is then that I understood the science content. Often, I thought, “I wish our teachers would teach us in this way. I wish they would explain more. I wish they would show us things.” I can say from personal experience that seeing and doing helped me to understand. That is why I try to show things to my students.

I teach in the “normal” way, that is, I do not use any special way to teach. I believe my success as a teacher depends on my ability to transfer my learning to the students. There are a number of teachers in my school who have a great deal of knowledge but cannot convey that knowledge to the students so that when, after their period, I go into their class the students ask me, “*Miss*, we have not understood this or we have not understood that. Could you explain to us?” It is easy for students to learn something that they have understood, instead of just learning things by heart. I am very happy when my students get good marks. I am happiest when my students' results are announced and I have their marksheets in my hand to see that they have scored high marks. This year, one student in my Board chemistry class scored 74/75 and the majority of the students scored marks in the 70s. I am very pleased with the good results.

Teaching Science to Class 7

In this section I will describe a series of three lessons that I taught in class 7 on the topic of water. In the first class I began the topic of water with a demonstration of filtration. In the second class, I taught the physical and chemical properties of water. In the third class I helped the students to *tick* (mark) the correct answers to given questions and write them in their notebooks.

First lesson on the topic of water. On my way to the classroom, I went to the laboratory to collect materials for my class. Just then I saw Zia, a student of my class. I asked him to fill the beaker with water and bring it to the class.

As we entered the classroom, Hashim was ready to leave. He wanted to go and comb his hair because Sir Matthew, their class teacher, had made a “pony” (tail) with his long hair and tied it with a rubber band. This is a punishment that Sir Matthew uses to encourage boys to keep their hair short. Hashim had long hair which was sticking out from where the “pony” had been; he obviously needed to comb his hair so I let him go. But the students informed me that even Asad needed a ponytail made. He did indeed have hair as long (or even longer) than Hashim, but obviously he had escaped punishment. The other boys, especially Hashim's friends, resented this unfairness and were hoping I would take similar action with Asad. But I ignored the comment. I do not like to give harsh punishments to my students and that is one reason that I always have difficulty in managing my class. Boys need harsh punishments but I do not have the heart to do it.

I wanted to get on with the topic at hand and as it was a new topic, I also wanted to make sure that everybody had their textbook, or at least had access to one. A number of students were without textbooks but I went about the class to make sure that each pair of students had a book to share.

Everybody in the class was familiar with water. So I quickly elicited from the students the three forms of water, both in English and Urdu: ice, water, and steam. I reminded the students that in the chapter on light, I had done the molecular structure of solids, liquids, and gases with them. I asked the students to tell me the difference in molecular structure between the three forms of water. I wanted them to see the connection between molecular structure and the three forms of water.

I told them that 75% of the Earth's surface is covered with water and the remaining 25% is land. I then listed the kinds of water and their purity. I told the students that sea water is most impure with 3.5% impurities, and then comes river water and well water, and the last, that is purest form of natural water, is rainwater. The students always feel comfortable with me to pipe in with a joke or two. In eliciting the kinds of water, some students said gripe water, a concoction very commonly used in Pakistan for colic in babies. This contribution was a source of great mirth to the class. I asked the question:

Munazza Sheikh (MS): Where do we get water from?

Student₁: From the house, pointing to the water bottle hanging on the chair brought from home.

Student₂: From the wall.

Student₃: From a tank (underground water storage tank).

I wanted the students to realize that water is almost never pure. If we took water samples from different sources such as seawater, rainwater, pond water, and tap water and allowed it to evaporate naturally, all would leave residues behind to show that they had impurities in them. As it is difficult to obtain clean water, I wanted to demonstrate to students how water is cleaned to make it safe for drinking. As I moved towards the apparatus, the students got excited. The boys started to talk all at the same time, though

the girls were very quiet. I worry about the girls in class 7. They are very quiet. They hardly ever participate in the class.

I want the students to think so I put the question to the class:

MS: How can water be made fit for drinking?

The students respond enthusiastically:

B₁ (Boy): We boil water.

B₂: We filter it.

G₁ (Girl): By boiling it.

B₃: Miss, *ubalnae* (boiling) *se*.

B₄: *Garam karna* (by heating).

G₂: *Chann-na* (passing water through a fine cloth).

I accepted all the responses. Then I put the dust I had brought with me in the beaker of clear water. The dust settled down at the bottom. I looked around for the glass rod that I should have brought with me. Not seeing one, I borrowed a pencil from the girl in the first row. I used it to stir the dust into the water to make it into dirty water. I showed this beaker full of brown water to the class and asked how I could clean this water. Students again offered lots of responses:

B₅: Not with a funnel!

B₆: With a machine.

B₇: With a plant.

Most probably he meant in a plant, but that was enough for the sense of humour of the class to surface.

B₈: A plant? You mean a fruit? A pineapple should do it!

I told them that all of that was OK, but in real life we used a tank full of sand and *bajri* (pebbles). After the filtration through the sand and *bajri*, a calculated amount of chlorine is added to the reservoir of water. One part of chlorine to two million parts of water or something like that to make the water suitable for drinking. After this explanation, I started setting up the apparatus for filtration. I took out the filter paper from my handbag and held it high while I folded it appropriately so all the students could see it. Then I fitted the folded filter paper cone into the funnel and carefully poured the dirty water into the funnel.

As soon as I reached this stage, the boys started to come close to the table. I kept sending them back. Many boys stood up at the back; I asked them repeatedly to sit down. Students complained that they could not see. I tried to shift the table in a way that would improve the visibility. This made other students complain loudly that they could not see. I wanted everybody to see so I raised the whole apparatus high up in my hand. That improved matters and almost all could see. But I could not keep holding it up in my hand for long. Some of the boys suggested that I could raise the apparatus by making a

platform with the help of student registers. I mentally rejected the idea as I would need a large number of registers and collecting them would take up a lot of the class time. I then left the filtration apparatus on the teacher's table in front of the class. I wish I had thought of this before so that I could have arranged for a stool on which to place the apparatus so that all could see it. Now it was too late to do anything. The boys are crowding around me and the science apparatus now, and if I leave the class to get the stool, they will certainly get into some mischief.

While the filtration process was taking place, I explained the words "residue" and "filtrate" to the class. I think it is important at this stage for students to know the vocabulary of science. As the filtration proceeded, I moved on to the topic of distillation and explained that this process needed a special condenser called the Liebig's Condenser. I showed it to the students by referring them to the second diagram on page 83 of their textbook. While I was explaining, some boys continued to focus their attention on the filtration process as clean water fell drop by drop into the flask. Notably among them were Hashim and Mukesh, who were standing near the teacher's desk. While I was explaining, Hashim put some chalk dust from the blackboard into the funnel. Some of this chalk dust fell into the flask and mingled with the clean filtered water. I did not realize at that time what was happening behind my back. The boys were not interested in the distillation process I was explaining; they were more interested in the filtration. Some others had seen the demonstration of filtration in class 6 and were not interested. A group of about 7 such boys were acting out at the back of the classroom. The class had become very noisy.

After a few minutes, enough water had filtered into the flask for the students to see the difference between the original dirty water and the clean filtrate.

B₁: Now the water is clean.

B₃: But it is a bit yellow.

MS: It is a bit discoloured because Hashim put chalk in it.

B₄: Miss, should I drink and see what happens?

MS: No.

MS: What are the methods to make dirty water into something that we can drink?

S: Filtration and chlorination.

S: Distillation.

B₁: Fertilization.

B₂: Violation.

As I said, this class has a sharp sense of humour and it takes very little for them to slip in a joke or two. Here the boys tried to see how many words with the ending -ation (and sound "shun") they could come up with. I glared at the offending boys and the others continued to respond appropriately to my question:

S: By boiling.

S: Chann-na.

I then went to the next topic at hand, the water cycle. I asked a question:

MS: Why doesn't the water finish (evaporate)?

Sajida (the girl in the front) gave a brief explanation of the water cycle in a very low tone of voice. I doubt if anybody could hear it and I was tempted to tell her to speak loudly but then changed my mind. I was thankful that Sajida was responding and if I had asked her to speak up she would have clammed up.

Mukesh: Miss, does water ride the bicycle?

This was Mukesh trying to be funny about the cycle part of the water cycle process. Though I enjoy their sense of humour but I try to ignore their jokes in class. I saw that there was no time for any further work so I requested some students to help me put away the apparatus. The bell rang at 4:50 and it was the end of the class.

Second lesson on the topic of water. At the beginning of this class I spent some time briefly reviewing the previous work. And then posed the question:

MS: If we have a beaker of water, how can we be sure that it was water or some other liquid?

I told the students that litmus paper could be used to test for water. I took out two books of blue and red litmus paper from my handbag. I showed them how to use the litmus paper as an indicator by dipping it into the liquid. I told them that if we dipped the blue litmus in the liquid there was no change. Then even if we dipped the red litmus paper there was no change either. That means the liquid is water. I told them there was another more accurate test for water using anhydrous copper sulphate. Even if a drop of water falls on this powder it turns blue. But since the school lab did not carry this chemical we used the litmus test.

Zia said that the *Iodex* (a pain relieving balm) changes to blue. I was confused; where did Zia get the idea of Iodex? It was when I started the next activity using sodium metal that I realized that Zia had mentioned Iodex because I had brought the sodium metal to the classroom in a small empty bottle of Iodex.

I then started to discuss the physical properties of water. I listed some of the important physical properties of water:

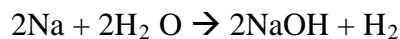
- The freezing point of water is zero degrees Celsius.
- The boiling point is one hundred degrees Celsius.
- It is a very good solvent and dissolves many things in itself.

Then I moved on to the chemical properties of water. I first talked about the reaction between sodium and water. As is my practice, I took this opportunity to review the symbols, valences, and equations with them. I was glad to see that most of students knew the symbols and valences.

I further tested their previous knowledge by asking:

MS: How can one tell the valence of an element if one knows the formula?

The girl Sajida, sitting in the front, answered. I then explained the reaction of a metal such as sodium with water with the help of a chemical equation. I wrote on the blackboard:



I asked the reason hydrogen was written as H_2 rather than H. I then proceeded to demonstrate this reaction to the students in the class. I took out a small amount of sodium metal with the help of a pincers and put it in a beaker one-fourth full of water. There seemed to be some bubbling about. The students got very excited and I told them that I could see some gas being generated.

I told them that if we put the red litmus paper in the liquid, it would turn blue and most students in a chorus finished my sentence by saying, “that if we put the blue paper in it, it would turn red.” This is not what I had intended to say. The same solution could not do both – turn blue litmus red and red litmus blue. This meant that they had understood the change of colour but had not understood the significance of this change of colour. I stopped in my tracks and asked:

MS: Does the change in color take place whether you put the blue paper or the red paper in the liquid?

I know that this is a crucial point and I stopped further instruction to clarify this point. I explained that a solution can change the colour of only one type of paper. If the solution is acidic, it will turn blue litmus red and if it is basic it will turn red litmus blue. But one solution cannot change the colour both ways.

I then turned my attention to the sodium metal. If the blue paper turns red, then it means it is an acid. I then put the blue paper into the liquid and demonstrated that there was no change, so the substance formed by the reaction was not an acid. The girls at the far corner were not interested and were busy chatting.

I then put a red litmus paper in the liquid, it was supposed to turn blue to show the presence of a base, but there was no change. I wondered what was wrong. This reaction usually took place easily. I put another piece of sodium with the pincer into the beaker, hoping it would jump-start the reaction. As soon as the boys got a hint that things were not going as they were supposed to, they surrounded the table so that the rest of the class could not see what was happening at the table at all.

It appeared that the red litmus paper when dipped in the liquid did change colour. The change in colour was so slight that the students were not sure that there really was a change of colour.

I asked the boys to go back to their seats. I gave them the example of the girls who never got out of their seats. I demonstrated the test again and this time showed it to the girls pointing out that the change of colour was not very perceptible due to the poor quality of the litmus paper.

After demonstrating the reaction of sodium metal with water, I was ready to discuss the reaction of other metals on water with the help of the general equation:

Water + active metal \rightarrow Hydroxide + hydrogen gas

Third lesson on the topic of water. The next day as soon as I entered the class I noticed that Hashim who had the “pony tail” yesterday had had a haircut. I did not comment on it. I had to do the questions and answers on the blackboard. I usually require class 7 students to copy the questions in a rough copy and then later transfer it to their notebooks. I wrote the questions on the blackboard:

- Question. 1. Give the occurrence of water in nature.
- Question. 2. How many types of impurities are found in natural water?
- Question. 3. How many types of natural water are there? Explain each of them.
- Question. 4. How would you show the presence of impurities in natural water?
- Question. 5. Explain water cycle.
- Question. 6. How many methods are there by which water can be purified?
- Question. 7. What are the properties of water?
- Question. 8. What are the uses of water?

Once all the students had copied the questions, I started to tick mark the answers to the questions in their textbooks. I asked the students to open their books on page 81. The ticking of the answers proceeded without much disruption, though there was a lot of joking about the word cycle attached to water cycle.

I had completed the lesson before time so I asked the students to write the questions and their answers in their notebooks. Most of the students ignored this request and talked among themselves. Only a few did the work suggested. I was tired and sat down in the chair to rest a few minutes before the bell rang. I asked the students to learn questions one through four for their homework.

My Family Life

By the time the school ends the sun is ready to set and both my sister and I are keen to get home. It takes us over an hour to reach our home in North Karachi. I say my prayers and eat dinner with my family. At dinner everyday for the last seven years we say a small prayer for my brother Aftab, who died suddenly. After that I watch some TV. Then I open my books either to study for my Masters or to prepare my lessons for the next day.

We are eight sisters and one brother who belong to the *Mohajir* community. My grandparents migrated to Pakistan from Allahabad, India, in 1947. We actually had two brothers, but as mentioned above I lost my brother Aftab at a very young age. He had just completed Interscience and was ready to go to an engineering university. He and I were sitting together completing the forms needed for application to the university. I left the room for a few minutes to go to the bathroom. On my return I saw him lying face downwards. That was the last that I saw him alive. This traumatic event has left a lasting impression on all of us siblings. I have been particularly affected as I was the one with him during his last moments and I used to share a room with him. He was very intelligent and would have made a very competent engineer.

Now when I look at the students in my class, particularly boys, I want to make sure that they study and do well in their exams. I see my role as teacher not only to complete the curriculum but to teach in such a way that students get good marks. That will enable them to get admissions to professional institutions and they will be able to make something of their lives. My own example is there.

Munazza's Teaching Practice – Biographical Echoes

The brief portrayals of Munazza's life, in and outside the classroom, help us to understand the manner in which personal life experiences influence her decision-making in teaching.

Caught Between Two World Views

My interviews and observations showed a pattern. She calls these patterns her normal way of teaching. A recurring pattern that can be seen in her teaching is a not-so-subtle shift from a demonstration-based science teaching to the recitation method. By recitation method I mean a teaching technique where the teacher explains a topic dictates answers to selected questions for the students to copy into their notebooks and learn for later regurgitation. It is after an innovative demonstration-based science teaching that she switches to the recitation method of teaching with which she was exposed while studying in school. To make sure that the students know the answer to the preselected questions, she dictates the correct answers to the questions. She assigns homework at the end of the period, which is usually in the form of learning the answers dictated and completing their notebooks. Assessment consists of checking that the students can reproduce the correct answer, which is usually undertaken either orally or in the form of written tests.

This rather abrupt shift is due at least in part to her own experience of science learning in the school. She experienced and learnt through the recitation method; hence she continues to feel comfortable in using it. During the interviews she alluded to specific teaching strategies that she drew directly from her experiences as a student in the classroom. If this method worked for her, she has a good reason to believe that it will work for her students who are working within a similar system. Another reason for switching back to the tried and tested recitation method is that the students and parents are socialized into thinking that the real work of the school resides in the written work in the students' notebooks. Munazza and at least two other science teachers of KMSS told me that when they do activities with the students, the parents and many students themselves believe that no work of value has been done in class. In my experience this view is not idiosyncratic to the students and parents of KMSS, but is also reflected by students and parents of other schools in Karachi.

Miss Samina, an experienced science teacher of KMSS, told me that when she conducted activities in her class, parents complained that teachers “spend a lot of time in play and do not teach.” However, both Munazza and Miss Samina were insightful enough to realize why this was so. Tapping at one of the student notebooks on the table, Miss Samina said, “If our exams are composed of questions from this notebook then naturally the students and parents think that other activities are not important.” Another reason for the shift to the recitation method is her need to cover the syllabus and remain

synchronized with other sections of the same class. In my conversations with the science teachers of the school, all of them laid strong emphasis on covering the syllabus. That meant completing the required topics to teach and ensuring that the students had copied the answers to a given number of previously determined questions into their notebooks before the start of the term exams. Munazza's determination to bring activities into her classroom was particularly laudable as the three term exams and one final exam, with its accompanying preparation and correction time, took up a large amount of time during the school year.

Class Demonstrations – Teaching the Way She was NOT Taught

Munazza starts the lesson by reviewing the previous work. Sometimes she uses the session to elicit information about the topic to be taught; in the lesson on water, for example, she used the first ten minutes of the class to elicit the three states of water and their properties from the students. In most cases she uses the time for a simple review of the important parts of the previous day's lesson. Then she starts to explain the basic elements of the topic using lecture method often turning to write important points on the blackboard. When she feels that a sufficient knowledge base has been acquired by the students to understand the activity, she conducts a simple demonstration at the teacher's desk in front of the classroom to illustrate the concept being taught. In the lesson on Excretory System in class 8, she brought a sheep's kidney to show the students an example of a mammalian kidney.

In class 7 she illustrated one of the methods of making water fit for drinking by demonstrating filtration in class. Despite the class management problems, the demonstration enabled the students to see the process being studied. In another lesson, she brought a preserved specimen of a frog to illustrate the different bodily systems and point out their similarity with, or differences from, the human body. While teaching the classification of animals into vertebrates and invertebrates, she demonstrated the concepts by bringing in preserved specimens of different species to the class.

She uses science activities for illustration of concepts that she has taught or is going to teach, in the latter case they serve as advanced organizers for the lesson to come. It is basically a means of communicating to her students the facts of science. According to Munazza, if she tells students that the mammalian kidney is bean-shaped it is not going to register in their minds as much as if they actually see and handle a sample. This aspect of her teaching routine is in stark contrast to her own experience of learning science in school. Her experience was not positive. She yearned for teachers to show her what they were teaching about. She wanted to see, smell, and hear about science. When that was not forthcoming, she took to doing the science activities illustrated in her book with her siblings.

Munazza's need to "see it for herself" is now reflected in her teaching methods. She wants the students to have concrete visual experiences – to see things happen – and to have the kind of experiences that she yearned for when she was a student. Even her selection of the kind of demonstrations to conduct in class further illustrates this desire. For example, in order to depict the reaction of metals with water, she chose the reaction of sodium metal with water. Water reacts with other metals slowly or not at all, but with Alkali metals, such as sodium, it reacts violently and visibly to form sodium hydroxide

and hydrogen. Hydrogen catches fire and burns with a blue flame on top of the surface of water adding a dramatic touch to the demonstration, though it did not work as expected. She continually tries to teach the way she had wanted to be taught but was not.

Strategizing for Success in the Board Exam

I also observed a few lessons where Munazza was teaching chemistry to class 9, a Board class. I concluded from these observations that both Munazza and her students knew that this was a “game” that they had to play to beat the system that expected them to memorize the answers to a list of questions. The most economical way to win this game was to learn the answers to selected questions that had a greater likelihood of inclusion in the Board Exams. Since the setting of the paper follows a set blueprint, it is considered fair to guess and to prepare the students thoroughly for the expected questions. Teaching to the test is not new and it is practiced everywhere, but here it seemed to dominate the lesson planning completely. The reasons for these practices are not hard to find - there is enormous pressure on the schools from parents to ensure that students obtain high scores. High scores will increase the chances of the students to get admission into the few good colleges in Karachi. Competition is intense. Students themselves want to get good scores because their future is at stake. Hence schools, teachers, and students do not allow anybody to interfere with this goal.

For Munazza, the disadvantage of not obtaining sufficiently high scores is a lived experience. She felt dreadful when a difference of a few marks, rendered her ineligible for admission to a medical school in Karachi. Hence, she understands the dilemma of the students and does her best to see that students get high scores. If the Board Exams dominate and affect the teaching in the Board classes, it might be easier to accept and even condone the practice. However, the Board system of exams carries at least two other grades in its wake: grade 7 and grade 8.

In an effort to see that students get the highest scores possible, at KMSS and many other private schools, the syllabus of classes 7 and 8 is enriched with topics that belong to the class 9 and 10 Board science curriculum. I have called this practice “teaching science to classes 7 and 8 with an eye to class 9 and 10.” This practice in my view gives rise to a number of issues: (a) students are exposed to concepts and ideas for which a sufficiently strong foundation has not been built, (b) students are burdened with additional topics in an already heavy curriculum, and (c) the students who will not “get” science in grades 9 have to study content which is not a part of the official curriculum. However, this practice is not only entrenched at KMSS, but in other schools in and outside of Pakistan (Kanu, 1996; Tan, 1991).

Class Management

Munazza has difficulty in managing her class. She is well aware of her weakness and it is one of the first elements of her teaching that she discussed with me. During my first interview with Munazza, she told me that she was concerned that her classes were very noisy. She wanted me to help her to improve her ability to manage and control the students in her classes, particularly in one section of class 8, which in her view was full of low-ability boys. During my observation of her classroom it became clear that she was

correct about her own analysis; the noise and out of seat behaviour was a great challenge for her to tackle.

After a few days in the class, I discerned a pattern to the misbehaviour of the students. I used Doyle's (1986) definition of order: "Order in a classroom simply means that within acceptable limits, the students are following the program of action necessary for a particular classroom event to be realized in the situation" (p. 396). This allowed me to construe misbehaviour as any action that disrupted the order in the class and threatened the learning of other students. Allowing for the fact that order is contextual in nature and depends on the action taking place in the class, I was able to categorize student behaviour in Munazza's class into six large and crude categories. All of these behaviours were exhibited while instruction was taking place:

- (a) Loitering behaviour where students walk about the classroom with the intention of changing seats, pass a message, or just to walk about.
- (b) Not doing seatwork and distracting others who were thus engaged.
- (c) Fooling around, such as playing "catch" with pencil cases, playing with small objects as a key-chain.
- (d) Doing school work other than that taking place in the class.
- (e) Surrounding the teacher's desk during a demonstration and handling the equipment when asked not to do so.
- (f) Talking to each other or commenting on the class process out of turn.

At times it seemed that the misbehaviour in the classroom had become "invisible" to Munazza; and at other times, she appeared to be very frustrated because a great deal of class time and her energy was spent in settling down the students. She attributed student misbehaviour to her inability to use the more draconian forms of discipline that the other teachers used. But mostly she saw the problems in terms of factors external to herself. She attributed the class management issues she faced to the fact that the majority of her class were boys. She said, "In an all girls classroom order and discipline must be non-issues. But I have always taught boys sections so I always have had to deal with these difficulties." She also attributed the lack of discipline in her class to the lack of motivation and interest in science due to the low ability of students.

She specifically refers to the three or four older boys who do not want to study and hence have failed most classes at least once, and are now much older than the average student in the classroom. There is some support for Munazza's beliefs in research findings. For example, Levin, Libman and Amiad (1980) found that high achieving students were actively engaged in the class twice as much as low achievers. And the same study shows that low achievers were engaged in misbehaviour almost three times as much as high achievers. Another study by Metz (1978) observed high and low-ability classes taught by the same teacher. The misbehaviour in the low-ability class was public, disruptive and order was difficult to restore.

Science as a subject carries high status (Spender & Sarah, 1988; Young, 1976). This affects both the teachers who teach this subject and the students who study it. This is not a novel idea. Munazza draws a great deal of prestige from her position as a science teacher and prefers to teach the more 'able' students. She also gets a lot of acclaim and praise for the high rate of student success in the Board exams, which is taken as a sign of

her competence. But the school believes that all students cannot take up science as a career and hence a system of selection and separation of those who can study the high status subject from those who cannot. In Pakistan, all students study General Science up to class 8. After that they have the option to take science, commerce, arts or home economics. Sometimes students choose not to study science, but for the majority of the students the decision is made for them based on science, mathematics and English marks in the class 8 final exams. The students who act out most in Munazza's class are those who know that they will not "get" science in class 9. Munazza sees it as evidence that the low ability students do not want to study science. I think both factors are at work. The system of tracking is certainly not responsible for Munazza's class management problems but I do believe it is a contributing factor.

Since Munazza had requested support to help her to manage her students better, I looked for opportunities where I could offer some suggestions. I felt that Munazza was reticent to accept help because it entailed taking out time from her already hectic pace and schedule. The pressure to complete the syllabus, to prepare students for the four exams in the year was relentless. Lack of time was exacerbated by the fact that KMSS is an afternoon school. Coming early or staying late to work with was not feasible. However, it seemed to me that it was much more of a "personality issue" than a matter of giving some "tips of survival" to Munazza. To be able to handle her classes better she might have to rethink her conception of care and control.

Tensions between care and control are endemic to teaching. For Munazza care for students is one of the central aims of teaching but teachers also need to deploy their legitimate authority to control the learning environment (Mclaughlin, 1991). In contrast to much research literature, where the findings indicate that the need to control overrides the need to care (Goodman, 1985; Tabacnick & Zeichner, 1984), in Munazza's case the opposite appears to be true. Her need to care has overcome her need to control the class. Yet she cannot ignore the need to exercise her authority over the students. Authority is essentially power (Giddens, 1979), but Munazza hesitates, or perhaps does not know how to use this power in a way that satisfies her need to care. So she has partially "given over" the authority in her classroom to the Principal Madam or the class teacher by threatening to send students to them if they misbehaved.

Munazza believes that students are not scared of her and that is why they misbehave in class. She thinks she could gain control of the class only if she used the rod on them or behaved in a way that the students were always afraid of her. But if she did that she would not be a caring teacher. Munazza does not appreciate that "control and caring are not opposing terms; but the form of control is transformed by the presence of care" (Bowers & Flinders, 1990, p. 15). Hence, I was at a loss to help her with her class management mainly because of the tension Munazza felt between caring and control. She has to find the right balance between her desire to care for the students and her need to control them. She did not need class management tips from me, she gets plenty of that from her sister who also taught in the same schools – she needs to think and reflect on her conceptions of care and control. I think that the discussion during the interviews had started to make her think about her class management skills and the part she played in it. Retrospectively, I think that I could have been more proactive in encouraging her to reflect and reconceptualize her ideas on management and control.

Understanding Comes Slowly and in Stages

During the interviews it became clear that Munazza separated learning into two forms: memorization and understanding. She knew that her methods of teaching encouraged memorization but she believed that understanding would come, albeit slowly. She knew that during her teaching only a small percentage of the class understood the science concept, while most of them just memorized the text. However, she believes that as they proceed with their studies, they would slowly understand more of the science.

Let me take the specific example of the language of chemistry. The class 7 and 8 curricula does not require the teaching of the language of chemistry and the science textbooks in use at KMSS do not use symbols and equations to denote chemical reactions. For instance, the combination of carbon with oxygen to form carbon dioxide gas is represented as:

Carbon + Oxygen \rightarrow Carbon Dioxide

But Munazza and all the science teachers in the school expect the students to write it in the form:

$C + O_2 \rightarrow CO_2$

She teaches balancing of equations to class 7 and expects students to have memorized the symbols and valences of elements and radicals from a photocopied sheet provided. Further, she also expects them to know (or remember) that oxygen (and other gases) is usually in a diatomic state. She also teaches them to differentiate between the different kinds of chemical reactions: synthesis, decomposition, and double decomposition. All of this is expected of the students without the concept that equations are expressions of molar quantities being taught. It is taught more than a year later, in class 9. I want to stress that this is a typical manner of teaching the language of chemistry and not idiosyncratic to Munazza or KMSS or Pakistan.

Munazza has been able to justify this practice in her own mind by separating the goals of learning science as both short-term and long-term. The short-term goal of learning science is to learn the answers by rote, pass exams, and get good scores; the long-term goal is understanding. Understanding will come to those who take up the study of science in the higher classes. She explained to me that:

I was very interested in science activities from a young age. Any activity that I read in the textbook, for instance about the bending of a pencil when dipped in a glass of water, I would do at home to see what would happen. Why did it bend? I would do most of these activities with my sisters, Maryam and Nadia. Usually our textbook had pictures illustrating the activity and a method on how to do it. We followed the instructions closely and tried to see what happened. The "reason" for why such and such happened was usually given in the textbook, but very often we did not understand these explanations. It was much later, when I went to first year and second year of college that I realized that what we had observed

(referring to the bending of the pencil) was refraction. This was true for a lot of science that we did in school. I understood the concepts much later. (Interview # 3 with Munazza)

Understanding of science concepts also comes through teaching them. Munazza said, “Each time I plan to teach a lesson I learn something new.” She also said she enjoys the learning aspect of teaching science and said that she has understood far more science since the time she has started to teach it. As a student, her learning depended on the questions that the teacher wanted her to learn, but as a teacher she has to know everything about a topic to be able to teach it well. She always tries to be a few steps ahead of her students and prepares the content thoroughly using books that belong to her siblings who are studying in college and university.

Munazza’s Teaching Practice – Societal Influence

The data shows that Munazza’s teaching while powerfully influenced by her personal life experiences is also influenced by society. It could not be otherwise as personal life is not lived in a vacuum but in society, which is bound to have influence on one’s conceptions of teaching science.

Preparing Students for Success is Her Moral Responsibility

Professional rewards and social pressures are connected to conventional school performances. Munazza considers it as her moral responsibility to see that the students succeed in the conventional way, as defined by society. Munazza accepts the success of her students in the exams as her prime goal and lets the understanding of the students take secondary importance. Munazza's own experience with the recitation method has resulted in success for herself and her siblings. Her methods of teaching have ensured students' success in the examination and reaped appreciation from the administration of the school.

Munazza attributes her success as a teacher to the fact that she could transfer her knowledge to the students while a number of her colleagues, though very knowledgeable, could not do that. She understood the difference between teaching for understanding and rote memorization, and understood that both occupied a different place on the teaching learning landscape. She believed that to succeed in the exams it was necessary to commit to memory large sections of the text, and hence proceeded to teach in that way. She is very proud that, rarely do her students take coaching outside her class. She recalled that her schoolteachers also took full responsibility for preparing them for success in the exams and she too must do the same.

Munazza feels that it is her responsibility to see that *all* students in her class have learnt the lesson. She feels strongly about teachers who do not care whether students have the required notes in their notebooks. Her ardent interest in student learning is obvious from the passion in her voice and the fire in her eyes when she talks about this issue. She has strong views about teachers who do not try to fulfill this responsibility. She sees this responsibility in three ways. One, she has to make sure that all the students have necessary materials to learn, that is, they have the notes in their notebooks. Second,

she ascertains that the students have learnt the required questions by going to each student in the class and requiring them to respond orally to a question she has put before them. I observed four teaching periods when Munazza utilized different ways to see that this goal was achieved. If she thought that time would run out before she got to all the students she used the method she saw her teachers use in class. She as a monitor was often asked to "hear the lesson" from other students. Twice I saw her request a monitor in her class to work with her and hear the lesson from one end of the class while she worked with students at the other end. The third way that she tries to fulfill her responsibility towards student learning is to teach all the three disciplines of science as well as she can. Though her strength obviously lies in chemistry and biology, as she has studied these two subjects at the Bachelor of Science (BSc) level, she tries her best to teach exemplary lessons in physics too.

Content and Pedagogical Content Knowledge

Munazza has a good understanding of school science, her colleagues and head teacher acknowledge her strength in the area. However, like the three teachers in Grossman's (1990) study, she equates class preparation with subject matter preparation. For example, when preparing her "mental plan" of teaching, she usually thinks of the content to be taught based on the textbook. Then she chooses the classroom activity and thinks a great deal about the conceptual issues that might arise pertaining to the planned activity or demonstration. But she does not think about the practical aspects of doing an activity in class. Mundane details such as where she will put the apparatus before she gets to the activity so as not to distract the students, or how will she ensure that all students are able to see what she wants them to see in a demonstration, or where and how will she dispose of litter such as used filter paper, matchsticks, water etc., were not thought out in advance. They were unplanned and dealt through on-the-spot improvisations. While such improvisations are a necessary part of a complex activity such as teaching, over-reliance on impromptu planning suggests that Munazza conceives of thinking about content knowledge as lesson planning and tends to disregard practical implications of her method of teaching.

My own experience is that when science teachers think about teaching science they pay attention to subject matter knowledge and do not give as much importance to pedagogical issues. Subject matter knowledge is a very important part of being a teacher but not the only part. An understanding of how to transform and reformulate this knowledge for students in a way that is accessible to them is a key component of knowledge for teachers. Despite the strides research in teacher knowledge has made in the last two decades (Fenstermacher, 1994), there are experts everywhere who think that all teachers need in order to teach is the knowledge of the subject matter to be taught. That is, they need to know the same things as students, though perhaps in greater depth.

This is a belief that Munazza and the other teachers in the school possess. Munazza sees the content knowledge of the subject as separate and perhaps more important than pedagogy. The teacher knowledge that integrates subject matter with pedagogy and which differentiates the way a teacher knows science and the way a scientist knows it, has not gained currency with Munazza. The school leadership including Chair of the Board of Trustees and the Principal of the school also think

similarly about science teaching. They regard knowledge about the subject matter knowledge as being of paramount importance. Both of them are extremely satisfied with the standard of science teaching prevailing at KMSS. They are rightfully proud that the afternoon shift secondary school has science teachers who are all science graduates and have the appropriate content knowledge to teach science.

Agar Chorni Pari tu Chhor Doongi (If I Have to Leave Teaching I will Leave It) - Is She Really Committed to Teaching?

Munazza is at a very difficult stage of her life, a waiting stage where she cannot make many long-term decisions about her life because the big decision of her marriage is yet to be made. However, instead of being rooted into this passive way of thinking, she has shown clear signs of moving ahead; she has decided to do her Master's in Islamic History. The decision has been made keeping in mind the various constraints of balancing a full-time job and her studies. Islamic History is probably not her first choice, yet it is something in which she is interested. Whether she continues to teach in a school or seeks out an opportunity to teach Islamic History in college and leaves school teaching remains to be seen.

One of the difficulties with female teachers in Pakistan is that they cannot commit to the profession until they are married and know their new circumstances. Not knowing the course of their life, they continue to flow with the tide until circumstances become such that they have to become more serious about the profession. That is why Munazza told me that, "*Agar chorni pari to chor doon gi* (If I have to leave teaching I will leave it)." Lortie (1975) has also shown his awareness of a gender division in teaching. He has reported that women teachers in their twenties do not get deeply involved in their careers as they are "hedging their bets" to cover contingencies related to husband and children. These sociocultural dimensions affect teaching as they have impact on the professional development of teachers.

Conclusions

Though contextual factors and societal influences do affect Munazza's teaching of science, the overriding influence has been her own teaching and learning experiences in school. When I compare Munazza's way of thinking about teaching with those of her sister Maryam or her colleague Miss Samina, I see a difference. Both have been exposed to professional development and hence have some experiences to "hook" their efforts to change their practice, whereas Munazza uses her "apprenticeship of observation" (Lortie, 1975) to provide models for teaching. Her repertoires of teaching methods include either the teaching methods she experienced or the one's she did not experience but wished she had. She makes great effort to use methods like demonstration in science, but then quickly switches back to the tried and tested methods of her past experiences partly because of her lack of knowledge of how to take them further.

The unity of the personal and the professional in the life of a teacher is reinforced by this study. The findings concur with conclusions drawn by researchers such as Ball and Goodson (1985) and Goodson and Cole (1993) that "We teach who we are" (as cited by Cole & Knowles, 2000, p. 27). A teacher's personal biography and experiences of

school and undergraduate courses influence the way she teaches. Consciously or unconsciously our life histories are a part of our professional life. Our experiences of growing up, our experiences within the family and the community at large, our experiences of being taught in schools and institutions of higher learning all contribute in shaping who we are and what we believe as educators.

Conclusions of this study emphasize that early experiences influence beliefs and behaviors regarding teaching and learning. Enabling teachers to identify these life experiences provide them with insight into their philosophical position about education and pedagogical decisions taken in the classroom. The life history is always a retrospective reconstruction. Often it is not the facts and events of the life story that are important but the interpretation given to them that are meaningful for the teachers. Opportunity for teacher educators to engage in this kind of reflection with teachers has some distinct benefits. It has the potential of making explicit the difference between a teacher's *theory-in-use* and espoused theory (Argyris & Schön, 1980). Through this confrontation teachers can become more aware of their theory-in-use and learn to act more effectively in and outside the classroom. If teachers are to act as pedagogical change-agents, then new ways of thinking about teaching and knowledge have to become a part of their experiences – a part of their lives. This study has made it clear that teachers are much more likely to use methods of teaching or ways of thinking that they were exposed to when in school or college.

Connelly and Clandinin (1988) use the term personal practical knowledge to express a knowledge that resides “in the teacher's past experience, in the teacher's present mind and body, and in the future plans and actions” (p. 25). Though a teacher's knowledge is deeply personal it is profoundly contextualized. The teacher cannot be separated from the broader social, cultural, and political dimensions. Teachers cannot separate themselves from the expectations of the various stakeholders such as administrators, parents, and students; these serve to shape the way they teach. Munazza has a unique perspective of teaching based on her life history but she is also a product of her time.

Hence, the study highlights a paradoxical picture of teaching: all teachers are different and unique, their teaching being guided by their life experiences, yet classrooms are often striking in their sameness. There are many descriptions of science classrooms available in the literature that could match Munazza's effort at teaching science (see for example Tobin & McRobbie, 1996). Munazza's effort to “talk her way out” of a failed demonstration is well documented in the literature (Nott & Smith, 1995). That is one reason why Munazza's classroom practice and teaching methods, while personal and unique, are in many ways similar to science classrooms in other parts of the world. These common ways of thinking about teaching have been called *traditions* by Louden (1989) and *cultures* by Feiman-Nemser and Floden (1986). These traditions or cultures are constituted of many things, including expectations of administration, other teachers, and students. Teaching in the classroom is often determined or even distorted by factors outside the school, such as the Board Exams or parents' expectations. Limited resources, particularly time and space, add constraints to teachers' own ideas or beliefs about teaching.

Eisner (2000), offering a distillation of 12 *easy* lessons for the next Millennium, writes: “The school as an institution is more likely to change the incoming message than

the message the institution” (p. 347). He attributes the robustness of schools to the structure and traditions in which schools participate. Everybody knows how schools operate and have some expectations and ideas about how they should operate. In this sense the students and teachers know how schools work. This knowledge about schools is embedded in the life history of teachers. By paying attention to the life histories of teachers one could possibly shape the message to have the maximum impact. Using the biographies of teachers to understand their practice could help teacher educators to devise programs that are better suited to their needs, beliefs, and aspirations.

The major impact that this research study can make is on the professional development practices in Pakistan. Munazza's example shows how closely personal experience as a student is related to teaching practice. It has highlighted how a teacher's individual life events can affect teaching. Helping teachers to uncover and understand these critical incidents can help them to understand and reconceptualize their teaching. Munazza too benefitted from this study mostly in the form of professional development. I found the research process as a source of both reflection and learning for Munazza. She had not thought about her practice or about her evolution as a science teacher over the eight years she had been teaching. After the sixth interview there was a breakthrough of a sort in our relationship which resulted in the two of us planning and teaching a lesson together. This “double discourse” (Pedretti, 1996, p. 324) of collaboration with a teacher while simultaneously engaged in research enhanced my understanding of the teacher and her practice rather than detracting from it. It also benefited her from the collaborative experience of working and teaching with a teacher educator in her classroom.

Freeman (1992) has identified a number of problems that frequently emerge when studying life histories: (a) intrusion of the present on the past, (b) the possibility of deception and (c) insufficient development of principles and criteria for selection of life history stories are three challenges that I faced. Describing the difficulty that a researcher faces by the intrusion of the present upon the past, Vaillant (1977) writes: “It is all too common for caterpillars to become butterflies and then to maintain in their youth that they had been little butterflies” (p. 197). The affect of the present on the past is a dilemma because the person telling the life story may want to tell the facts but can do so only under the light of the present circumstances. When collecting stories about a person's experiences, it is often difficult to tell whether the person is telling the truth or not. Truth and deception are relative. As discussed, the present events of life often change the meaning and significance of past events and make the idea of truth or deception complicated. The past is not static, it is dynamic. Who is to decide what is the final truth? How is it possible to tell whether the researcher and the teacher are engaged in the process of creating “congruent fiction” (Hitchcock & Hughes, 1995, p. 198)?

Another problem associated with the life history method is that the principles and criteria for selection and representation of data are underdeveloped. Mandelbaum (1982) explains this dilemma very succinctly: “the method has more promise and less actuality” (p. 147). In addition, Kluckhohn (1945) has complained about the deficiency of analysis and interpretation in life history documents. Life history has also been criticized for being labour intensive, time-consuming and requiring a high degree of interpersonal skills (Plummer, 1983).

One of the ways in which I have counteracted this difficulty of method is by using both retrospective and prospective data. So in a sense I have supported the data from the

past with immediate lived experience. This was achieved through a long period of participant observation which has given an ethnographic feel to the study. Because I observed the teacher in her own classroom for a considerable length of time, I think there is little chance that I have confused “fact” with “fiction.” Among the science teachers in the school was her sister, I included her in my interviews and used her stories to better understand Munazza's stories. I tried to maintain an interpretive vigilance over the data at hand and was very sensitive to any disjunction in the data and sought clarification from the related person/s. I have also complemented Munazza's stories with stories from other teachers.

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