Understanding how Improvement-Oriented High School Teachers Pursue Curriculum Adaptation in High Schools in Gilgit-Balitistan

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Abstract

This article sets out to describe and explain how four improvement-oriented teachers1 (hereafter to be referred as IOTs), in their day-to-day teaching, pursue curriculum adaptation as a part of their continuing efforts to promote in-depth student learning in high schools in Gilgit-Baltistan. The data on which this paper is based comes from a 1-year long in-depth study (doctoral thesis research project) concerned with describing and explaining the process of change experienced by four improvement-oriented high school teachers in Gilgit-Baltistan involved in efforts to implement small changes of their own choosing in the three distinct yet interconnected realms of the classroom, the school and the community. Presenting illustrative examples from four IOTs' teachingthe study provides a broader picture of the IOTs' endeavors aimed at curriculum adaptation in the classroom. The study establishes the primacy of the teacher in bridging the gap between student learning needs and mandated curricular material. It recognizes the influences the teachers'actions, pedagogical moves and decisions exert on students' learning are more powerful than the knowledge contained in the curriculum. The study, thus underscores the importance of the contextualization of learning and an active engagement of the teachers with the process of curriculum adaptation as a vital condition to reduce the gap between student learning need and curriculum material.

Key words: *Improvement-oriented teachers, teachers' change experiences, pedagogical change, curriculum adaptation/ enrichment, in-depth student leaning, learner centered pedagogy*

Introduction

In education, curriculum is an important means of achieving educational goals. The formulation of national curriculum therefore needs to be based on a set of explicitly articulated goals. Such goals may reflect an emphasis on the development of a capable and a decent human being, who is intellectually, socially, culturally, and morally competent and responsible. This is to suggest that the educational goals of national curriculum need to reflect a focus on the multidimensional growth and development of learner. Such a holistic development can be fostered through promoting student-centered interactive learning, creativity, critical and divergent thinking, inquiry and exploration, construction of knowledge by the learners and a quest for continued learning and reflective thinking by teachers and students. Such a progressively-oriented curriculum needs to question the trends in educational practices and approaches, such as teacher centrality in learning process, passive and examination-oriented learning, summative evaluation, textbook dependence, and inflexible or controlling learning environment in the classroom.

The notion of curriculum does not have a universally agreed-upon definition. The concept of *curriculum* is widely open to discussion, interpretation, construction and deconstruction. Many educators have defined curriculum as comprising all experiences in school that are planned by teachers or administrators. However, others have argued that curriculum includes all experiences that students have in school, planned or unplanned (e.g. Beauchamp, 1981; Doyle 1992; Marsh and Willis, 1995; Pinar, 1975; Posner, 1998; Saylor et al., 1981). According to Doyle (1992: 569), curriculum is what "students and teachers jointly construct in classroom setting… [it is] embedded in the classroom events constructed by teachers and students". As elaborated by these theorists, curriculum may consist of a pattern of courses, guidance, specific instruction, physical activities, opportunities for experiences, testing and evaluation, modes of interaction, or any or all of these.

However, in this study, my focus is on the IOTs' efforts towards making the planned curriculum meaningful for students through practices such as enriching, adapting or expanding the

experiences or knowledge that constitutes the planned syllabus, which in Pakistani context is a means to achieve curricular goals.

In Pakistan, secondary school curricula comprise subject areas in the domains of social and natural sciences (e.g. Social Studies/ Pakistan studies, History, Islamic Studies, languages, Mathematics, Biology, Chemistry, Physics, etc.). Teachers are central to implementation of the curriculum. Looking from teachers' perspectives as implementers of curriculum, a variety of tensions and challenges can be recognized that confront them in their efforts to pursue pedagogical improvements. Challenges surface when teachers attempt changes in lessons in order to make them meaningful and rich educative experience for students. Firstly, the curriculum guidelines and the syllabi and the textbooks that have been designed with little or no input from teachers, do not sufficiently reflect students' and teachers' interest, students' learning or developmental needs, teachers' and students' aspirations, beliefs, values, and expectations. Secondly, textbooks, which are the only sources to achieve the educational goals stipulated in the national curriculum, are allegedly replete with knowledge gaps, biases, misconception, partial or narrow views, gender and religious prejudices, outdated or redundant information. (e.g. Government of Pakistan, 2002, 1999, 2009; Hoodbhoy, 1998; Rahman, 2004; UNESCO, 2005; University Grants Commission of Pakistan, 2001).

More often than not teachers either by choice or by compulsion have to follow textbooks religiously. Teachers' primary responsibility in the classroom not to transmit the bookish knowledge to students' minds rather key role in curricular transaction is to adapt curricular knowledge to cognitive, social and cultural learning needs of the students. Use of interactive teaching methods alone may not help students in gaining in-depth understanding of subject knowledge; therefore, teachers would need to reinforce learning and development through adapting curricular material. In their attempts to promote in-depth student learning beyond the bounds of textbooks, teachers would provide relevant information from whatever sources they have, challenge their learners to think, find information themselves and try out what they have learnt.

Against the backdrop of these circumstances, within the broader focus on exploring the IOTs' change experiences in the realm of classroom, this study investigated teachers' curriculum adaptation practices with the key assumption that individual teachers' challenges to curricular implementation in the classroom, even those issues that arise from curricular implementation differ; so do their response to those challenges. The IOTs, under the influence of a number of individual characteristics such as personal commitment, professional knowledge, knowledge of and care for students, and personal values and experiences would engage in efforts to convert curriculum content into a meaningful learning experience for their students.

Literature review

Curriculum adaptation, as an important component of curricular transaction, has received greater attention in the discussions of pedagogical improvements. However, overview of the literature reveals that most studies have focused on externally mandated curriculum innovations. There has been little discussion on how teachers voluntarily, in their day-to-day lessons, engage in enriching or adapting the curriculum and respond to the tensions that arise from execution of curricular material. Fewer studies have examined curriculum adaptation or enactment exclusively as part of routine instructional practices or have investigated how teachers in different educational contexts and different subject areas apply or adapt curricular material in their day-to-day teaching.

Nevertheless, internationally, a few studies have examined in-depth how high school teachers with inclination to continued improvement engage in instructional reform, with a focus on curriculum adaptation as change of their own choosing. These studies report that teachers engaged in improving teaching and learning consider adapting curricular material to students' learning needs and interest as their key responsibility. The implementation of externally mandated curricular changes differs from curricular innovations voluntarily attempted by teachers (Campbell, 2006*).*

Typically, the process of curriculum adaptation includes teachers deciding about changes to make the content relevant, rich and

interesting by omitting, substituting or supplementing mandated curricular activities or materials (e.g. Brown, et al., 2009; Campbell, 2006; Deng, 2009; Harris, 2005; Paliwar & Subramavida, 2006; Paris, 1993; Smith & Lovat, 1990). A closer look at the conclusions about the change experiences of high school teachers who either have tried to be effective and efficient or have successfully implemented instructional improvements in the classroom suggests a shift away from traditional transmission-oriented teaching towards learner-centered pedagogies that emphasize the learners' central role in the educational process (e.g., Beattie, 2004; Drake & Miller, 2001; Hammerman, 1999; Kilbourn, 1992, Klettle, 2000; Matsumoto, 1999; Wildman, 1991). In a learner-centered environment, the learners meaningfully interact with subject matter by trying to construct their own meanings of it (e.g. Bredo, 2000; Brooks & Brooks, 1999; Phillips, 2000). The gaining of in-depth understanding of the subject matter stands out as an important instructional goal of teachers' attempts to improve what they do in the classroom. To achieve this goal, change-minded teachers use a variety of pedagogical approaches premised on the principles of interactive, learning-centered teaching.

Moreover, studies from both Western and non-Western contexts that have explored how *good teachers* or *good schools* have dealt with change have established that, in order to optimize students' academic learning, *good* or *effective* teachers generally try to structure their core learning activities around three components of pedagogy—teaching methods, curriculum and evaluation. Thus, curriculum adaptation stands as a vital goal of instructional improvement intended at impacting students' in-depth learning controlled largely by teachers. Case studies of the teachers who exhibit strong commitment to change try to find their own ways to address the challenges that arise as a result of their efforts to transform the academic and social environment of their classrooms in which teachers major responsibility lies in mediating between curricular material and students. In so doing, they draw on their own professional authority and understanding. As Campbell (2006: 111) points out, "**…**professional authority is located not within the parameters of those curricular expectations, usually defined by forces external to the teacher, but rather within the

teacher's own capacity to exercise curricular and pedagogical knowledge with discretion, judgment, and proficiency". Campbell cites Hansen'ss (2006) dictum that teachers' professional authority is generated through teachers' preparation, experience and dedication; teachers need to honour curricular authority but they are also answerable to their own professional authority. They need to exercise this authority with wisdom and care. Similarly, Smith and Lovat (1990) underscore the need for teachers to create curricular decision-making space for themselves so as to feel that they have autonomy and can actively make decisions relevant to their practices; thus decision-making, for the individual teacher, requires a perceptually-defined sense of freedom and authority. Likewise, Brown et al. (2009: 364) view teacher-curriculum relationship as "an agent-tool prelateship" in that that curriculum is not a static object in the hands of teachers but rather is a tool that both "shape and are shaped by human action through their affordances and constraints".

As reflected in the literature, curricular adaptation involves both content and methods in which students interact with the learning material in ways that help promote in-depth learning of subject matter knowledge. Curriculum adaptation combines all of the efforts including content, instructional choices, culturally sensitive and pedagogically informed decisions involving use of a variety of instructional strategies (e.g. Benz-Peretz, 1990; Chan, 2007; Connelly & Clandinin, 1988; Cuban, 1992; Harris, 2005; Hart, 1981; Wildman, 1991). Broad-based curriculum adaptation efforts by teachers extend beyond mere addition or omission of information or learning activities. Interactive teaching methods, active cognitive engagement, culturally and developmentally appropriate curricular material and formative evaluation techniques can improve student learning and development (e.g., Connell, 1985; Drake & Sherin, 2006; Fullan, 1993; Harris, 2005; Hawthorne, 1992; Kilbourn, 1992; Paris, 1993; Rand & Corno, 1997). This explains the crucial role teacher plays in mediating between the student and his or her curriculum. Often teacher's role is reduced to passing information from textbook onto students. Teacher' role goes beyond it; he or she needs to intervene in the learning with his or her experiences, values, knowledge, and understanding. As

Paliwar and Subramavida (2006: 49) argue, "There are indeed good and bad teachers but a good text cannot substitute even a bad teacher". This suggests that curriculum materials (textbooks/syllabus) are intended at creating a kind of learning experience for students. Therefore, the curriculum materials cannot adequately address students' learning needs; therefore, the teacher would always have to play a role in mediating between learners and curriculum. In other words, the teacher needs to transform the subject matter by interpreting and enacting it to suit learning to individuals with varied characteristics (e.g. particular age, background, and of particular experience and interest). As observed by the researchers who have studied teachers self-initiated pedagogical changes, the learner-centered interactive teaching methods typically involve problem-solving, inquiry-oriented activities, finding information, seeking reasons, constructing arguments, tasks that are interdisciplinary and related to their lives outside school, students, working with other students whether cooperatively as a whole class, small groups and jigsaw groups or in pairs (e.g., Drake & Miller, 2001: Halai et al., 2004; Pepin, 1998: Perkins, 1992: Solangi & Hassan, 2004: Thiessen & Anderson , 1999: Upadhyay et al., 2005).

In a nutshell, curriculum adaptation is an integral part of instructional improvement and can take different forms; these may include activities, use of multiple sources of information, use of a task other than those suggested in the curriculum to teach a particular concept, or use of technology to assist learning such as calculator, computers and video technologies. By and large, teachers' use of curriculum adaptation rests on the teachers' authority or agency to decide what to teach and how to teach in practice. Because curriculum materials are designed with a focus on school subject as a special kind of experience for the learner; therefore, exercising his or her agency, a teacher can develop his or her personalized conception of curriculum through modifying, interpreting, enacting or adapting the materials to suit it to his or her unique teaching context. Thus, from a pedagogical point of view, enriched or modified curricular content that is reinforced by a wide variety of innovative teaching methods and assessment techniques would mean better and diversified opportunities

for students to think and participate in the learning process via more channels and angles.

Methodology

By IOTs, I refer to experienced good teachers, whose reputation as change agents on the frontline of school improvement is widely recognized by peers, administrators, parents, and the community. They stand out, work hard and persist with little institutional or collegial support. Despite many challenges, they consistently engage in improving what they do in the classroom and the conditions in the school and outside it that affect their classroom practices. The four teachers (3 male, 1 female), were selected through purposive sampling process, come from three high schools (2 associated with government and 1 belonging to a private school system), recognized for their committed to improvement. The teachers were selected as a representative of those surveyed in purposive sampling process and all displayed a high level of commitment to curriculum adaptation as part of their efforts towards enriching students' learning experiences.

To generate data for the study, a qualitative case study methodology was employed, which used in-depth interviews, classroom observations, post-observation discussion, and document analysis, as tools for data collection. The case study method allowed in-depth investigation of the teachers' curriculum adaptation practices and the beliefs and values underlying them (Merriam, 1988). Thus, the data upon which this article is based comes from transcripts of in-depth teachers‟ interviews, (5 in-depth interviews with each teacher), classroom observations (13 observations), post observation discussions, instructional material used by the teachers (e.g., examination of text book content, activity sheets content, etc.). The in-depth face-to-face interviews sought to examine the participants' perception of and experiences with curriculum adaptation practices. The interview questions formulated were open-ended, to facilitate in-depth answer and allow the participants to raise issues, reflect on experiences in dealing with these issues.

However, the interviews and classroom observations and post observation reflective discussions were guided by two key questions:

(I) Why do the teachers attempt curriculum adaptation?
(II) How do they approach curriculum adaptation during their routine teaching?

In line with these questions, two major categories were used to process the data: (1) teachers' views about teaching and learning, with particular focused on curriculum adaptation, and (2) the manner in which the teachers approach curriculum adaptation. Thus, as a result of content analysis (Miles & Huberman, 1994), a range of themes emerged relating to teachers' curriculum adaptation practices, which were then compared across the four sub cases and cross cutting key themes were identified, findings were formulated and conclusions were drawn based on these key theme pertaining to teachers' curriculum adaptation practices.

Subjectivity issues are inevitable qualitative research. In this research subjectivity issues were addressed at multiple levels; at data collection level efforts were made not to influence or interfere in the research setting or by documenting activities, events, incidences and anecdotes as they occur. Similarly, data generated by interviews were recorded as objectively as possible and analysis and interpretation of the data was carried out without making value judgment of what was said or done by the respondents.

Findings

Tradition-oriented teachers usually view teaching as synonymous with transmission and equate learning with memorization of factual information from the textbooks or the teacher's talk. . Alternatively, the IOTs stress that teaching needs not to be mere knowledge transmission; its goals go beyond traditional instruction. Teaching means creating an environment that is safe, enabling and rich with opportunities for students' learning and development. The teachers need to creatively facilitate in-depth understanding of subject matter knowledge by providing opportunities, means and authority for children to interact with material, construct meaning, explore knowledge by themselves and test their own understanding in order to take responsibility for their own learning.

There seems to be a variety of reasons as why the IOTs attempt to adapt curricular materials to their students' learning in their day-to-day teaching. However, central to their effort is the purpose of promoting in-depth learning of subject matter knowledge. Because the IOTs are mindful that, they need to adopt approaches to teaching curriculum content that goes beyond just dispensing information contained in the textbooks. The IOTs seem to be concerned about students' understanding the concepts in various curriculum subjects, attempt to move away from merely transmitting textbook knowledge and facts; instead, they focus on the learner's active engagement in the learning process. The following excerpts from interview transcripts, field notes and teachers' reflections, explain what they mean by *in-depth understanding* or *conceptual learning* and how they foster in-depth learning of subject matter. One of my research participants, Mazher Khan (pseudonym), for example, emphasizing the importance of in-depth student learning in the area of science, says:

> The knowledge in the syllabus [textbook] is static; concepts are not reinforced with *reasoning* [emphasis in mine]. But I want children to raise questions. For example, children learn about electrostatic force or static charge. But do they know how the flash of a photo camera works? Merely knowing about static charge, or having a limited knowledge about the function of the flash system so that students can describe that it [flash system] produces light because of the dry cell inside the photo camera, does not provide sufficient evidence to presume that they have understood how a photo camera works as a system. Children need to learn the concept to extent that they understand how the charge is stored in the capacitor [a component used in electric and electronic devises] inside the flash and how it gets released to produce light. If students describe the capacitor, its structure, and its function, then it would imply that they actually

> understand the function of the flash system of a camera and the application of static charge. (Excerpt from teacher's interview)

Mazher Khan's perception of learning subject matter with understanding implies that the learner can offer reasons and explanations, make connections, focus on core scientific ideas or knowledge, relate subject matter to the actual physical environment and understand how scientific knowledge gets translated into technology.

Irfan Baig (pseudonym) concurs with Mazher Khan, saying, "In science, when children get exposed to a definition first, learning becomes difficult. It limits their thinking and narrows their vision, akin to a buggy-horse with eye blinkers" (Excerpt from teacher's interview). Irfan Baig emphasizes learners' self-construction of scientific definitions; he believes that memorizing ready-made definitions from textbooks or a teacher's notes may deprive students of productive mental engagement with the concept. Reflecting on a specific lesson, Irfan Baig says that the problem he faced was children' relying on the textbook's definition, rather than paying adequate attention to the ideas, reasons, situations, and facts, underlying the phenomenon. He explains:

> Children believe that memorization of a definition is the only way to learn a concept; they have no idea of alternate ways to learn scientific definitions. When they memorize, they forget easily. I do not offer ready-made definitions; rather, my first priority is to take students through examples and processes to derive meaning from given information. Students work through simple examples and construct their own definitions. In this way my students easily understand the material and actively participate in the lesson. (Excerpt from teacher's interview)

Irfan Baig points out that in traditional classrooms students do not learn definitions and concepts deductively, but through rote memorization. As a result, these students lack the ability to commit the

information to long-term memory. Short retention is the inherent disadvantage of learning concepts through memorization. As an alternative, Irfan Baig helps his students to deductively construct scientific definitions themselves by working through multiple examples.

Similarly, Mohammad Ali (pseudonym) emphasizes the teacher's central role in creating a classroom environment that inspires learners to interact independently with the material in order to nurture their mental capabilities. He argues:

> Our education system is based on cramming and memorization, and on reading and writing without regard to thinking. Activity-based methods or discovery and inquiry approaches to teaching and learning are not being practiced. I try to educate my students in a way that includes an element of discovery in learning, which, in my view, is an important element of a progressive education system. (Excerpt from teacher's interview)

Mohammad Ali underscores the need for instructional practices that help students engage in thinking, inquiry and discovery-oriented learning, which, he believes, are essential tools for promoting a deep understanding of subject matter. He commits himself to teaching not in the way that he was taught but in the way that he believes promotes in-depth understanding. Yasmeen Bano (pseudonym) also considers process-oriented learning as an authentic tool for enabling learners to construct their own understanding of concepts or phenomena. To elaborate, she reflects on one of her mathematics lessons which she taught on the concept of *volume* to Grad 6 students. She brainstormed about the topic to elicit students' prior understanding of it. Next, she picked up a sheet of paper, divided it into two equal pieces, and shaped them differently. She invited a student to come forward and fold the papers in two different ways to have two varied shapes. Then she posed the question: "Which shape will encompass the greater volume?" Half the students replied that both would have equal volume, while the other half said that the volumes would be different.

To examine the two contradictory hypotheses and verify the correct answer, she took students outside the classroom and asked them to fill the shapes with soil. The students themselves empirically confirmed whether or not their hypothesis was true or false. Yasmeen Bano encouraged the students to argue and provide reasons as why their hypothesis proved right or wrong. Had followed the tradition, straightaway she would have told the students the principle of conservation of volume.

Reading through these teachers' reflections and narratives above, I recognize a great many similarities among the conceptions of pedagogy they hold. They see learning subject matter as a dynamic cognitive process that requires learner's active engagement in constructing meaning of the subject matter under consideration. This vision involves more than the mere acquisition of new information or the simple memorization of readily available definitions, laws or formulas. Instead, it requires learners to undertake a range of cognitive processes, such as relating ideas and information, constructing meaning, defining phenomena operationally, deriving formulas, creating hypotheses, thinking, conducting inquiry, forming opinions or constructing personal meanings, reasoning, making connections, applying knowledge, and relating the concepts to examples in real life situations.

How the IOTs pursue curriculum adaptation?

Three kinds of changes concerning curriculum adaptation were recognized in the IOTs'classrooms. The first set of change related to the content and process of curriculum. The second types of changes involved negotiation with students in the process of developing student understanding around the subject matter under consideration. The third kind of change included instructional strategies aim at students' deep engagement with the subject matter. These changes are explained in the context of the significant ways in which the teachers attempt to adapt curricular material to their students‟ learning needs.

Analysis of qualitative data gather through classroom observation (observation of 13 routine lessons, each 35 minute long) and a set of five an hour long in-depth interview with each teacher

recognizes the following major strategies of curriculum adaptation the teacher used in their routine lessons: Optimizing learning experience; relating content to the local environment; expanding the scope of the topic; promoting deductive learning in mathematics; manipulating syllabus content; and (6) building upon students' prior knowledge.

Optimizing the learning experience

To explain this, I quote an example from one of my research participants teaching. Environmental pollution, ozone depletion, and their implications for sustainable development are important curriculum topics in the Grades 8 to10 Science and Social Studies textbooks. However, the information in the textbook is so limited that it does not help the students to gain insights into the diverse aspects of the concept of environmental pollution (e.g. its varied causes and consequences and the proposed strategies to counter it). Students living in the remote rural context of Gilgit-Baltistan find it hard to relate to the ideas about environmental pollution discussed in the textbook. Because of the geographical remoteness, absence of industries, and people's traditional lifestyle, environmental pollution has not yet visibly affected the natural environment. Students may be least familiar with concepts such as chlorofluorocarbon (CFC), refrigerant gases, industrial wastes, automobile exhaust, and other phenomena of urban life contributing to environmental pollution. In this context, students' understanding of the concept must be constructed from the fundamental level by familiarizing them with basic information.

On International Ozone Day, a local TV channel in Pakistan telecast a talk on *environmental hazards and repercussions for ozone depletion*. The TV programme focused on a wide range of issues and factors that allegedly contribute to ozone depletion and environmental degradation in Pakistan and elsewhere. To create a context for understanding environmental pollution, Irfan Baig had Grade 10 students in the staffroom and had them listen to a panel discussion on television. The panel comprised the Federal Minister for the Environment, an environmental scientist, an industrialist, and an activist for environmental protection. In addition, the anchorperson

was connected through video-conferencing with other people inside and outside Pakistan, such as a UNESCO's representative and various journalists. The discussion was rich, informative, stimulating, and lively. The participants spoke about various aspects of the topic, while pictures and video clips illustrated how human activities affected the environment. Students listened absorbedly to the talk from start to finish. They then discussed what they saw, heard and felt and what understanding or opinion they themselves bring to the topic (Excerpt for Field notes).

Irfan Baig thus provided the students with the opportunity to learn different types of information through a different medium (TV programme) instead of dispensing limited information from textbooks through talk or getting students memorized the information. This different experience was meant to provide the students with an alternate learning experience in order to broaden their understanding of an important curricular topic with important real-world implications.

Relating content to the local environment

Some of the IOTs' efforts at curriculum adaptation are concerned with linking curriculum knowledge to the students‟ existing experience. For instance, they refer to the local environment, including flora and fauna, landscape, geography, local material culture (food, dresses, artifacts etc.), and local stories, beliefs and practices. For example, in a science lesson about reptiles and invertebrates, Mazher Khan focused on the reptiles found in the local environment with which the students were familiar, thus helping the students relate the concept to their local environment and arousing their curiosity and interest. In the same lesson, drawing on his own knowledge about the behabviour of invertebrates, Mazher Khan shared with the students the interesting information that until recently, leech (an insect) was used to suck blood from a human's or an animal's body as a curative practice. Underlying the practice was the belief that an excess of blood, or in some cases polluted or poisonous blood, caused sickness. The leech was used to remove a certain quantity of blood from the body, thus treating the sickness. It was, indeed, an interesting piece of information that was new for the students.

When teachers share their own experience, this additional information not only enriches the curriculum content but also provides the teachers with the context to discuss belief systems from both a cultural and scientific points of view. Sharing such interesting information, and relating it to students' real life experience is indeed a worthwhile effort. On the one hand, it highlights the teacher's knowledge and ability to enrich curriculum knowledge, while simultaneously dealing with the beliefs and misconceptions that students bring with them about phenomena. On the other hand, it allows teachers who to understand subject matter deeply, widely and flexibly to help their students connect concepts, relate one idea to another and overcome misconceptions.

Expanding the scope of the topic

In the below figures: 2(a), 2 (b) and 2(c), I present sample of a lesson to explain one participant's efforts to create a context in which students become engaged in expanding the scope of the topic. Here, Mazher Khan tries to promote deeper understanding of the topic by expanding the scope of the topic through connecting scientific concepts and matching them with the students' interests and with the larger social environmental context.

Figure 1(a): A science lesson explaining how to expand the scope of the topic above.

Mazher Khan describes his lesson:

1.0 To teach the concept of *greenhouse effect* [emphasis is mine], teachers usually refer to the example of a greenhouse. But I approach the topic in an entirely different way. Textbook writers and other teachers perceive the background knowledge as understanding the *greenhouse*. But in my view, the background knowledge is more complex, deeper and broader in scope than is conveyed in the textbook. Behind the concept of a greenhouse is the concept of *infrared light*. Now, let us consider the question: What is infrared light?

1.1 I have to begin the lesson from here, the concept of *infrared rays or light*. Since infrared light is a form of light, I have to begin

with *light*. I even need to go beyond the concept of *light* to the concept of *rainbow* or *spectrum*. Hence, I kick off a lesson on the greenhouse effect from the concept of *rainbow*.

1.2 I pose these questions to students: 'What is a rainbow? How do you people perceive *rainbow* in your commonsense knowledge?' In the local belief system, people have different interpretations of the phenomenon of *rainbow*—why and how it forms. After having discussed the *rainbow* from a sociological perspective, I then engage the students in understanding the concept from a scientific perspective.

1.3 I come to the concept of *wave*, and explain the associated concepts such as *wavelength* and *frequency*. I then ask students, 'How many colours are there in the spectrum of the rainbow?' Students recognize and count the colours present in the rainbow; they obtain a rainbow by passing light through a prism [set up an experiment and do observation]. I ask, 'Above the *violet* there is another light: What is it called?' Students answer the question, but if they fail to do so then I explain: 'It is *ultraviolet*. Again I ask, 'And below the red light there is another light; what is it called?' It is *infrared* light.

1.4 These two lights, *ultraviolet* and *infrared* are not visible because their frequencies are beyond the capacity of our eyes to recognize them. I suspend the discussion on the *ultraviolet* for a while and pick up *infrared.* I explain that infrared light is used in cameras and night watch [night vision] systems. This is how infrared light is used in real-life situations. Also, the remote control system used in houses to control TV, DVD players, and other electronic devices uses *infrared light.*

1.5 When I am done with *infrared light*, I return to the *ultraviolet light*. I ask students to explain to me why the heat coming from the daytime sun can be felt inside the house at night. The students provide their own reasons. I elaborate on them and explain that the warmth you feel inside your house is because of the heat waves trapped in the house. The *ultraviolet light* enters the house through the window glass, but it cannot escape through the same medium after reflection; it gets trapped inside the

house, and thus keeps the interior of the house warm. Capitalizing on this phenomenon, glass houses have been built which are being used to grow vegetables in the winter season. This phenomenon is called the *greenhouse effect*.

1.6 What is the benefit of the *greenhouse effect*? Students share their views; I probe them and then give my own input. The benefit is that we get vegetable crops from the field around the year; plants do not cease producing in winter, because the greenhouse effect creates an artificial environment in order to provide all the conditions necessary for the growth of plants. When plants are provided with ideal conditions for growth, including humidity, temperature and water, the yield of plants, such as cucumbers and tomatoes can be increased.

1.7 We move on to define the *greenhouse effect*. Students are encouraged to define the greenhouse effect on the basis of the information discussed so far. I then share with them my explanation.

1.8 I tell them that the *greenhouse effect* is, in fact, the creation of particular seasonal conditions suitable for the growth of plants. Now the time is ripe for a discussion on the concept of *global warming*. I relate the greenhouse effect to the phenomenon of *global warming*, which is the actual context of the topic envisaged in the curriculum.

1.9 I explain to students that the carbon monoxide gas we produce through industrial activities, when combined with other chemical particles, builds a layer around the earth's atmosphere which acts like the glass of a greenhouse; this layer does not allow the *ultraviolet light* to escape into space after it is reflected from the earth's surface, and consequently the temperature on the earth's surface increases. This results in *global warming*. Hence, the whole planet turns into a *green house*.

1.10 The altered seasonal conditions caused by global warming may be suitable for crops such as cucumbers, but may not necessarily be favorable for wheat or maize. In this way, global warming caused by the greenhouse effect tends to disturb the harmony or equilibrium of the natural conditions on our earth. These changes

in the earth's seasonal conditions could have detrimental consequences for our existence, for the eco-system such as reduced crop production, leading eventually to a shortage of food, starvation and death.

1.11 Thus, to teach about the *greenhouse effect*, I began the lesson with the concept of the *rainbow*. The purpose is to complete the process of gestalt [by gestalt he means the learning cycle—getting information/experience, processing or reflecting on it, making connections and reaching the intended meaning or conclusion]. In the textbook, there are only 10 lines about the greenhouse effect. The way I dealt with the concept is comprehensive; we cover a great deal of content, students are involved in discussion and experimentation, questions are posed, and above all, students are encourage to think deeply. Students will not forget what was discussed, because they relate the concept to the context of their real-life situation. In this way we complete the unit in two successive lessons.

A close look at Mazher Khan's teaching practice reveals that he does not dogmatically follow the content knowledge in the textbook. He expands the scope of the topic, which requires him to extend the boundaries of the content area by making connections between ideas, linking the topic with subsidiary concepts, and considering the relationship between cause and effect. Many science concepts are interconnected or interdependent through a series of cause-effect relationships. A thorough understanding of these cause-effect relationships may lead students to a better understanding of sub-concepts and their relationship with the major topics in science.

Mazher Khan was concerned with the prior understanding students brought to the topic and its allied concepts. He tried to build on what students already knew about the topic by eliciting responses, discussing commonsense knowledge and connecting with the scientific knowledge. While exploring their prior knowledge, the teacher does not merely focus on the students' expert knowledge of the concepts; rather, he is interested in the cultural, social, or anthropological knowledge they possess or the beliefs they hold about the *rainbow*. People who are not aware of the scientific knowledge about the

phenomenon of *rainbow* may have their own perceptions of rainbow, which may not necessarily be in harmony with the scientific view. Instead, they could be grounded in culture, in a social or religious belief system. Such perceptions of a phenomenon that students bring to the classroom need to be valued and explored prior to presenting expert knowledge to them, as the above lesson demonstrates. Yet another important aspect of the lesson is its high interactivity: the teacher frequently asks questions, probes, requests reasons, challenges students' knowledge, judges their capacity for absorbing knowledge, encourages discussion, and provides opportunities for experimentation, observation and explanation.

Promoting deductive learning in mathematics

Algebra is generalized arithmetic, but when not introduced with concrete examples, the very basic algebraic concepts remain abstract rules. However, given concrete examples from the physical world, students can easily grasp what the algebraic concepts are all about (Skemp, 1971). As shown in the below figures 2 (a) and 2 (b), by using a pattern-seeking technique, an unconventional (in the Pakistani context) approach to learning algebra, Irfan Baig introduced the concept of *algebraic expression* to Grade 6 students. Irfan Baig's approach differs in major ways from the methods of teaching and learning algebra advocated in the prescribed textbook (memorization of formula, rules or principles), the key source of knowledge and instructional guide for teachers in Pakistan.

As explained in the below figure 2 (a) and 2 (b), the numbers on the left-hand side column relate to the numbers on the right-hand side of column in such a way that in each case the difference is 3. Following the pattern, students can predict the number on the right corresponding to the number in the sequence on the left. The difference between every number and the next in each column is an odd number. At a certain point, they reach a generalized conclusion. In this example, the generalized rule states that, given the pattern of numbers, every next number in the right (output) column should be obtained by adding „3" to the corresponding number in the left column (input). This generalized rule can be described mathematically as

output = input + 3 or y = x + 3, an algebraic expression or equation involving two variables and a constant.

Figure 2 (a): A mathematics lesson to illustrate deductive learning strategy

Involving the students Irfan Baig carried out the following exercise on the chalkboard

1.1	*Teacher:*	Input (x)	Output (y)
1.2		6	9 [difference between input and output is 3]
1.3		7	10 [difference between input and output is 3]
1.4		10	13 [difference between input and output is 3]
1.5		15	18 [3 is the constant in the emerging pattern]
1.6		22	25
1.7		31	34
1.8		100	103
1.9		111	114
1.10		1000	1003

1.11 In the expression x + 3, x is a number we do not know about. For example, if I tell you someone lives in Gilgit [name of a town), whom you do not know, it could be anybody; thus, we use 'x' to represent the unknown, which could be a person, an object or a number.

1.12	x	x + 3
1.13	y	y + 3
1.14	z	z + 3

1.15 This implies that if the input is A, then the output should be obtained A + 3.

1.16 In the expression x + 3, x is a number that we do not know and in the language of algebra it is named as x. What is x?

1.17 *Students*: Variable.

1.18 *Teacher*: And 3?

1.19 *Students*: Constant.

1.20 *Teacher* In algebra what would the whole equation be called?

1.21 *Student*: Expression.

1.22 *Teacher*: In x^2, suppose we represent x and the power 2 represents the ceiling of the room above us [the teacher used

the concept of *ceiling* as an analogy], x is called 'base' and 2 is 'exponent' or power.

1.23 *Teacher:*Tell me in y^5, base is ……? And exponent……?

1.24 *Students*: y is base and 5 is exponent.

1.25 *Teacher*: Let's have another example: $5x^3$ [apparently moving from easy to complex]

1.26 *Teacher*: 5 is called co-efficient, base is…? And exponent…?

1.27 *Students*: base is 5 and exponent is 3.

1.28 The teacher created a chart of algebraic expressions on the chalkboard and asked students to identify components of a given expression and complete the chart. Students completed the group task and one student from each group presented the work of her group. The teacher encouraged students by praising their contribution.

Pattern seeking is a useful instructional strategy to help students gain a better understanding of mathematical concepts, particularly the knowledge underlying generalized rules, principles, formulae, and theorems in algebra. Students learn to establish relationships, work with multiple examples and make generalized rule in order to construct a formula or a theorem. Together, these processes lead to a deeper understanding of the basic ideas, knowledge and concepts. The mathematics syllabi (Grades 1 to10) in Pakistan, devoid of examples, activities, illustration, and exercises dealing with pattern seeking, do not encourage a deductive approach to learning mathematics. In my experience, it is a rare for a Pakistani classroom teacher to introduce a primary mathematical concept in an unconventional way, such as the pattern seeking above. In the above example, Irfan Baig went beyond the textbook content and traditional approach to introducing the concept of algebraic expression. Had he used the traditional method, he would have copied an example of an algebraic expression from the textbook and had students memorize different parts of it. Instead, he involved students in constructing an algebraic expression. The whole process seemed to enable the students to comprehend the meaning of the variable „x" in the expression. This comprehension lies at the heart of learning algebra. As Skemp (1971: 34) notes, "Since many pupils learn to do the manipulations of arithmetic with a very imperfect

understanding of the underlying principles, it is small wonder that mathematics remain a closed book for them".

Manipulating the syllabus content

The IOTs report that they manipulate the syllabus by emphasizing key concepts and prioritizing or re-sequencing the teaching topics (deciding when to teach a particular topic regardless of its place in the textbook), in response to their unique situations and in order to enable students to cope with the demands of conceptual learning. For example, Mazher Khan teaches certain topics in Science related to plants (flowers, leaves, pollination, and photosynthesis) and certain topics in Social Studies related to agriculture (domestic crops, harvesting) only in summer, because students can easily relate these concepts to their summer environment.

> Irfan Baig adopts a similar approach to dealing with the syllabus by re-sequencing topics, especially in Chemistry. He explains: Had I been the author of this book [Chemistry], I would have kept the Periodic Table as the first chapter. In Chemistry, the Periodic Table should be taught first. Students" learning about concepts such as valency is dependent on their understanding of the concepts of *groups* and *periods* [in the Periodic Table]. I would say children who understand the Periodic Table well can easily grasp the whole subject. Here, the textbook defines the concept of valency as the *ability of an element to combine with another element to form a compound*. This is vague, and that is why it takes us three days to make children understand the concept of valency. (Excerpt from teacher's interview).

Irfan Baig criticizes the Grades 9 and 10 Chemistry books because their sequencing of chapters and topics lacks internal logic and coherence. The Periodic Table provides very basic information about the characteristics of the elements. Therefore, his suggestion of re-

sequencing textbook's chapters and shifting the Periodic Table from Chapter 3 to Chapter 1 may make a sense.

Building upon students' prior knowledge

Prior knowledge refers to the ideas, views, conceptions, information, and experiences students hold about a particular concepts or phenomena before being exposed to new academic knowledge. The IOTs consider learning as a developmental process in which earlier experiences provide the foundations for making sense of later ones. They believe that individual learners construct knowledge through an interaction between what already they know and new experience.

Yasmeen Bano, for example, considers linking students‟ prior understanding to a new concept as central to promoting conceptual learning: „If students‟ prior understanding of a concept is probed in-depth and breadth, it helps a great deal in fostering deeper understanding of the subject matter‟. Similarly, Muhammad Ali says, "For me it is highly desirable to consider how I can make connections between new learning and prior learning and how those connections can variously support or confound students‟ acquisition of new knowledge and understanding" (Excerpt from teacher's interview). Mazher Khan sees prior knowledge as a fundamental contributor in shaping new learning. He says, "Students possess a quite complex structure of ideas and experiences; and, if motivated and provided with proper help, they can gain deep understanding through interactions between new knowledge and previous knowledge of the concept". Irfan Baig holds similar views about building students‟ understanding of subject matter on what they already know about the concept. For example, reflecting on one of his instructional decisions during a mathematics lesson, he explains:

We have been taught [in the in-service programme offered by the AKES, P about self-directed learning, in that we believe that children possess numerous competencies. They possess the abilities for doing everything. If we provide them with opportunities they can do it [learn on their own]. If we do not give opportunity to the children, one thing that can happen for sure is that their confidence will not grow. Children carry with them a rich collection of ideas and

information. The only thing they need is guidance. The teacher's role thus becomes facilitator in the process of learning. (Excerpt from teacher's interview).

The IOTs' reflections underscore the need for valuing students' ideas, conceptions, opinions, experiences, and knowledge and linking them with a new knowledge or experiences. To accomplish this, they use techniques like brainstorming. By and large, the brainstorming strategy in the teacher's classrooms centered on four overlapping purposes: to get students to recall facts or knowledge (from information or ideas in a preceding lesson); to emphasize the information to be discussed with students; and to encourage students to express their ideas and listen to others‟ views; and to prompt students to think divergently and offer explanations.

Discussion

The IOTs' perspectives on and practices of instructional improvement explain as why they engage in curricular adaptation, as a change of their own choosing. Their efforts towards curriculum adaptations seem to be influenced by the perspective they hold about the knowledge and experience embodied in the prescribed textbooks; the teacher find the information provided in the textbooks lacking richness, diversity and depth; also content knowledge prescribed in the textbooks does not sufficiently reflect the geographical and socio-cultural realities of the local environment in which their students live and learn. The teachers therefore are required to bring their professionalism to bear upon the situation in which the mediate between curricular experience and their students' learning need.

In fact, the IOTs tend to espouse rather ambitious instructional goals emphasizing conceptual learning and students' academic development; their efforts towards curriculum adaptation seem to be aligned with these goals. The IOTs, therefore, attempt *curriculum adaptation* as means to support academic improvements by moving beyond the traditional ways of mediating between academic knowledge and learners. They attempt to open up the curriculum by creating or extending opportunities for students to engage with in-depth learning of knowledge, ideas and experiences beyond the bounds

of textbook. Engaging students in *deductive learning* (the process of learning in which student specialize examples, follow patterns and construct rules, principles or formula on their own), as manifested in the one of the lessons discussed above, the teacher in fact tries to create opportunity for students to broaden and deepen their understanding of primary mathematical concepts through pattern seeking and deductive reasoning. Such a cognitive engagement may not only help student gain deeper understanding into how mathematical rules, formulae, principles or theorems are developed but also expose them to practice such vital life skills as problem-solving and critical-thinking. Student equally contribute to curriculum enrichment process by voluntarily engaging in task, sharing personal experiences, participation in discussion, asking question and responding to teacher's questions.

A closer look at the manner in which the IOTs approach curriculum adaptation during their routine teaching recognizes the diversity in ways and approaches through which these teachers attempt curricular adaptation; they do not rely on one method but instead use a variety of methods and pedagogical techniques ranging from increased students' access to information to relating their classroom learning to students' real world experience. These methods or techniques necessarily involve one or more elements of learner-centered pedagogy characterized by enforcing individual responsibility in learning, encouraging discussion, questioning, reasoning, inquiry, problem solving, and offering explanations. Other pedagogical moves, such as considering new perspectives, expanding subject material, adding relevant information from other sources or relating material to local experiences, are used to enrich the experiences students gain in particular lesson structured around a curriculum topic.

It is important to note that most of curriculum adaptation activities or decisions, as highlighted above, are not preplanned; they occur in spontaneous fashion, with progression of the lesson. However, they seem to be influenced heavily by the teachers' experiences in the subject and their intuitively knowing about when to intervene with an appropriate material (information, activity) requiring students to engage in in-depth learning. In some situations, they,

however, involve direct actions or approaches (by engaging students in inquiry, problem-solving, discussion, and reasoning) to improving teaching and learning through mediating between students curriculum knowledge, which are structured around ideas or concepts provided in the textbooks. Using their best professional judgment, they decide about the knowledge, ideas or information outside the syllabus that, they believe, is relevant and can contribute to enriching students' understanding of the given concept.

Reflection on another important dimension of the IOTs' approach to curriculum adaptation sheds light on teachers‟ efforts towards contextualizing learning by relating content to the local environment. Such a contextualization of learning, according to the IOTs, can provide the students with the opportunity to engage in a meaningful dialogue that can enable them to understand how their local context interacts with the universal context or, in other words, how the curriculum knowledge relates to the students immediate social world. The above lessons, particularly the science lessons, reflect a strong emphasis on the need to link school science with students' immediate environment or the interaction between the local and the universal. The teachers at both theory and practice levels tend to emphasize the need for relating the subject matter of school science to society, culture, and technology. In the above example, the teachers' views about helping students to understand the application of science, especially the relationships between science and society, thus appears to be an essential aspect of adapting science curriculum to student learning. This suggests that individual, cultural and social conditions play an important role in teacher's deciding about the selection, interpretation and organization of curricular materials.

Similarly, the teacher's perspectives on re-sequencing topics or book chapters in fact allude to the awareness he brings to the understanding of the process in which scientific knowledge develops. Understanding how knowledge is developed can have a powerful influence on how the teacher organizes it for student learning. Because selection and sequencing of curriculum content is dependent on the understanding of how scientific knowledge develops and concepts relate to each other.

Yet another important dimension to curriculum adaptation is concern with establishing connections between students' existing experiences (knowledge, understanding, and personal views) and the subject matter under consideration. In is widely recognized in the contemporary literature that, in many situations, students already possess experience and knowledge that can be used as a base for learning a particular concept (e.g. Brooks & Brooks, 1999; Fosnot, 2005; Newton, 2000). The IOTs engage in deliberate efforts to link student prior experience to the subject matter under consideration. They try to help students either to recall information they have previously learnt or formulate the concept through evoking different examples or information from daily life experiences. However, mediating between students' prior knowledge to the concept under consideration we need to be cautious about the fact that, in some situations students might have experience or alternate framework that may not be helpful in the learning of a particular concept. Students find in-depth understanding of such concept difficult because of its conflict with their existing experiences. To deal with such a situation, the IOTs encourage their students to reconsider their alternate framework or critically reflect on their experiences by answering series of questions, engaging in reasoning, using examples, offering simple explanation with familiar examples from daily life, and using analogies.

Conclusions and Implications

The study has explained the role of teacher in curriculum adaptation and some of the ways in which the IOTs attempt to promote in-depth student learning beyond the boundaries of the prescribed curricular material. In the participants' classroom, curriculum adaptation efforts are intended at enhancing knowledge acquisition and understanding of key curricular concepts. Also efforts are made to relate students' classroom experiences to what they already know about the outside real world. The IOTs' quest to implement learner-centered teaching thus aims to transcend the mere transference of knowledge in order to promote deeper understanding of the subject matter and enhance students' capabilities to think creatively, critically and adaptively.

Analysis of the above insights from a deeper level leads to a few important conclusions. First, it can be argued that despite the

difficult conditions that shape the total teaching and learning environment in the classroom in Gilgit-Baltistan, the teachers who are proactively and continually engage in instructional improvement are not only exhibit awareness towards their responsibility in enriching students learning experience within the framework of the curriculum but also care for their students' in-depth learning and understanding. They appear to be knowledgeable about and skillful in turning curricular knowledge into a worthwhile learning experience for their students, no matter how alien, narrow and difficult is the concept for students to learn and master.

Second, the IOTs' proactive approach to adapting curricular material to students' learning needs seem to be inspired by their conception of their roles as teachers, their sense of commitment to their students, their willingness to try something new, and their interests in doing things differently. They hold high expectations of their students, believing that with appropriate help, support and opportunity for learning, to a certain extent, all their students can succeed and can learn beyond the boundaries of the prescribed curricular materials. They seem to believe that whatever additional support or guidance they can provide in terms of extending students' experience beyond the limits of curricular materials can make a difference in their students' lives.

Certain abilities or set of skills seem to be central in teachers' doing meaningful curricular adaptation. Of them the most relevant abilities are identified as: teacher's positive attitude towards the subject he or she teaches, his or her strong command over subject matter knowledge, interdisciplinary subject knowledge, and general knowledge. These observation accords with the conclusion Harris (2005) draws from her study of successful history teachers in Australia, in which teachers' success in adapting a new history curricula in part is attributed to their background as experienced history teachers who had a passion for the their subject.

Considered together, the IOTs' efforts toward curriculum adaptation explain the ways in which they attempt to structure learning experiences and opportunities for students in their classes beyond prescribed curricular materials. Their improvement efforts strive to

adapt curricular materials to reflect the kinds of experiences, knowledge, attitudes, and abilities that students need to acquire, learn and develop. More often than not the IOTs try to adapt curricular subject matter by providing additional examples or information; they attempt to relate the curricular content to the local environment so that curriculum knowledge reflects a broad range of the region's cultural, geographic, political, social, and economic realities. They also try to link concepts to students' own experiences in order to bridge the gap between curriculum knowledge and students' prior knowledge. By applying these strategies, they try to ensure that the knowledge they present sufficiently connects to the students' interest and learning needs within the given subject.

The lessons learnt in this study have important implications for teachers how teachers can be supported in their change efforts. It is desirable that teachers engaged in curriculum adaptation should be provided with the logistical/material, moral and professional support so that they could continue with their good efforts. Together they can contribute to creating an environment in the classroom and in the school at large which is conducive to teacher-initiated changes and in which teachers feel empowered and supported so that they are able to make independent decisions regarding curriculum adaptation.

To adapt curriculum material to respond more efficiently to the needs of their students, teachers need a reasonable degree of flexibility in both choosing content to enrich subject matter and the medium through which to effectively communicate the subject matter with the students. Teachers also need professional freedom to change both the spacing and sequencing of units or lessons they teach throughout the academic year. Currently, in Gilgit-Baltistan, the extent to which teachers are permitted to do this varies in government and private schools. Compared with private schools, teachers in government high schools have limited choice to make changes in content knowledge, spacing of units/topics and re-sequencing of textbook chapters. Empowering teachers in making small yet important pedagogical changes of their own choosing thus requires to creating a right balance between following prescriptions and enjoying flexibility in making pedagogical decisions. Also, teachers' curriculum adaptation efforts

are constrained by the centrally-controlled examination system. The end-of-term and end-of-year examinations tend to be product-oriented, thereby encouraging memorization. The lengthy school syllabi require teachers to cover vast content areas within a limited period of time. Engaging students in process-oriented cognitive learning or getting students to do more or do things differently within a limited span of time appears to be the biggest challenge facing IOTs in their day-today teaching. Thus, increasing flexibility in teachers' decision making also requires adaptation of student assessment. There is a need for policy change to adapt student assessment system to learner-centered pedagogy. It can enhance teachers' confidence to independently plan their teaching in response to students' learning.

Teachers, constrained by the policies related to curriculum and assessment are unable to address the central challenge of improving the quality of education—that is transforming the role of teachers from passive agent of transferring curriculum knowledge to active agent of creating or interpreting curricular materials to adapt it to students' learning needs. Teachers' grievance about the incompatibility between student learning and curricular materials could be redressed if their voice is included in redesigning and altering the perspectives and content of the school curriculum. Thus, there is a need to include experienced, proactive high school teachers in curriculum planning or redesigning curricular materials, let alone revising/rewriting textbooks.

Last but not least, the above examples of how IOTs individually pursue curriculum adaptation also indicate that teachers approach curriculum adaptation in different ways, depending upon their conception of curriculum, context and learner, and of their role in mediating between these. The extent or the ways in which the four teachers strived to enrich curricular material vary from case to case. This suggests that teachers attempting curriculum adaptation in different subject areas, with students of different grades should have different experiences; detailed investigation of such experiences remained beyond the scope of this study. Research studies are needed to do detailed comparative analyses of the ways in which high school teachers of such diverse subjects as Mathematics, Sciences, Social Studies, English, and History/Pakistan Studies approach curriculum

adaptation, with an emphasis on how teachers teaching different subjects in different grades incorporate lesson ideas, information and experiences from other subjects and classes. There is not enough literature that explains this in greater detail.

Taken together, the above discussions explain that the teachers' efforts towards or approaches to curriculum adaptation may not exemplify or suggest how high school teachers need to approach curriculum adaptation. Nevertheless, they are unique in their own right in that they explain how different teachers within a unique geo-political and socio-cultural context (e.g. remote, mountainous, rural context) perceive the notion of curriculum adaptation and approach it while organizing their routine teaching. Teachers pursuing curriculum adaptation on an ongoing basis as an instructional change of their own choosing is different from externally imposed curricular improvement innovations.

The IOTs curriculum adaptation efforts thus explain how they, as agents of pedagogical change, recognize their role in effectively mediating between curriculum and their students by engaging in efforts towards enriching and inserting the mandated knowledge despite the difficult conditions surrounding their teaching lives in remote rural Gilgit-Baltistan.

Notes

1. The researcher's notion of improvement-oriented teachers refers to the teachers who were recognized by their school communities (peers, administrators, parents, and the general community) for their commitment to school improvement and their sustained efforts to bring it about.
2. The teacher established a cause-effect relationship among concepts by referring to: industrial activities causing release of an abundance of carbon-monoxide gas into atmosphere thereby causing greenhouse effect which in turn causes the global warming with multiple consequences for the life on the earth.
3. A local nongovernmental organization that runs network of schools and organizes in-service training for teachers.

References

Beattie, M. (2004) *Narratives in the making: Teaching and learning at Corktown Community School.* Toronto: University of Toronto Press.

Beauchamp, G.A. (1981) *Curriculum theory.* Itasaca, IL: Peacock.

Ben-Peretz, M. (1990) *Teacher curriculum encounter: Freeing teachers from the tyranny of texts.* Albany: State University of New York Press.

Brooks, M.G. and Brooks, J.G. (1999) The Courage to be constructionist. *Educational Leadership*, 57(3), 18-24.

Brown, S.A., Pitvorec, K., Ditto, C., and Kelson, C.R. (2009) Preconceiving fidelity of implementation: An Investigation of elementary whole-number lesson. *Journal of Research in Mathematics Education*, 40(1), 363-395.

Campbell, E. (2006) Curricular and professional authority in schools (Editorial). *Curriculum Inquiry*, 36(2), 111-118.

Chan, E. (2007) Student experience of a culturally-sensitive curriculum: ethnic identity development amid conflicting stories to live by. *Journal of Curriculum Studies*, 39(2), 177-194.

Connell, R.W. (1985) *Teachers' work.* Sydney: Allen & Unwin.

Connelly, F. M. and Clandinin, D.J. (1988) *Teachers as curriculum planners: Narrative of Experiences.* Toronto: OISE Press /Columbia University Press.

Cuban, L. (1992) Curriculum stability and change. In P.WJackson (Ed), *Handbook of Research on Curriculum* (pp. 216-247). New York: Macmillan.

Dang, Z. (2009) *The formation of a school subject and the values of curriculum content: An analysis of liberal studies in Hong Kong. Journal of Curriculum Studies,* 14(5), 585-604.

Doyle, W. (1992) Curriculum and pedagogy. In P.W. Jackson (ed.), *Handbook of Research on Curriculum: A project of the American Educational Research Association.* New York: Simon & Schuster Macmillan, 486-516.

Drake, S., and Miller, J.P. (2001) Teachers‟ perception of their roles: Life in and beyond the classroom. *Curriculum and Teaching,* 16(1), 5-23.

Drake, C., and Sherin, M.G. (2006) Practicing change: Curriculum adaptation and teacher narrative in the context of mathematics education reform. *Curriculum Inquiry*, 36(2), 153-187.

Fosnot, C.T. (2005) Constructivism revisited: Implications and reflections. In C.T. Fosnot (ed.), C*onstructivism: Theory, perspective and practice.* New York: Teachers College Press, 276-292. Fullan, M. (1993) Why teachers must become change agents. *Educational Leadership*, 50(6), 12-17.

Glatthorn, A.A. (1992) *Teachers as agents of change: A new look at school improvement* Washington, D.C.: National Educational Association.

Glatthorn, A.A., and Fox, L.E. (2002) Supporting productive teachers. In J.T. Greer and D.W.Gresso (eds.), *Quality teaching through professional development.* California: Corwin Press, Inc., 42-54.

Government of Pakistan (1999) *Report of the Working Group on Education-1998-2003* Islamabad: Planning Commission.

Government of Pakistan (2002) *Report of the committee of experts on standard of education improvement at SSC and HSSC levels* (Islamabad: Ministry of Education).

Government of Pakistan (2009) *The National Education Policy 2009.* Islamabad, Ministry of Education.

Graham, R.J. (1991) Currere and reconceptualism: The progress of the pilgrimage, 1975-1990. *Journal of Curriculum Studies*, 24(1), 27-42.

Halai, A., Ali, M.A., Kirmani, N., and Mohammad, R.F. (2004) On-going impact of the Advanced Diploma in Mathematics Education. In A. Halai. and J. Rarieya (eds.), *Impact: Making Difference*: Proceeding of an International Conference held at AKU-IED, Karachi, Pakistan, 135-146.

Hammerman, J.K. (1999) Teacher inquiry groups: Collaborative explorations of changing practices. In M. Z. Solomon (ed.), *The diagnostic teacher: Constructing new approaches to professional development.* New York and London: Teachers College Press.

Hargreaves, A. (1991) Curriculum reform and the teacher. *The Curriculum Journal*, 2(3), 249-258.

Harris, C. (2005) Curriculum theorizing: Examination the middle ground of curriculum. *Curriculum and Teaching*, 20(2), 81-98.

Hart, K.M. (1981) *Children understanding of mathematics*: *11-16.* London: John Murray Publishers.

Hawthorne, R.K. (1992) *Curriculum in the making* (New York: Teachers College Press).

Hoodbhoy, P. (1998) Out of Pakistan's education morass: Possible? How? In P. Hoodbhoy (ed.), *Education and the State: Fifty years of Pakistan.* Karachi: Oxford Press, 1-22.

Ireson, J. Mortimore, P. and Hallam, S. (2002) What do we know about effective pedagogy: In B. Moon, A.S. Mayes, & S. Hutchinson (eds.), *Teaching, learning and the curriculum in secondary schools.* New York: Routledge Falmer, 64-69.

Kilbourn, B. (1992) Philosophical subject matter and classroom understanding: A case of history teacher. In T. Russell and H. Munby (eds), *Teachers and Teaching: From classroom to reflection.* London: The Falmer Press, 71-89.

Klettle, K. (2000) Working-times blues: How Norwegian teacher experience restructuring in education. In C. Day, A. Fernandez, T.E. Hauge and J. Moller (eds), *The life and work of teachers: International perspectives in changing times.* London and New York: Falmer Press, 146-158.

Marsh, j. C., and Willis, G. (2003) *Curriculum, alternative approaches, ongoing Issues.* New Jersey: Merrill/ Prentice Hall.

Matsumoto, C.S. (1999) Principals as colleagues in the reshaping of science teaching and learning. In M. Z. Solomon (ed.), *The diagnostic teacher. Constructing new approaches to professional development.* New York: Teachers College Press, 162-186.

Merriam, S.B. (1985) *Case study research in educational research: A qualitative approach.* San Francisco: Jossey-Bass Publishers.

Miles, M.B., and Huberman, A. M. (1994) *Qualitative data analysis: A source book of new Methods.* Newbury Park: Sage Publication.

Newton, D.P. (2000) *Teaching for understanding: What is and how to do it.* London: Rutledge & Falmer Press.

Paris, C. (1993) *Teacher agency and curriculum making in classroom.* New York: Teachers College Press.

Paliwar, R., and Subramavida, C.N. (2006) Contextualizing the curriculum. *Contemporary Education Dialogue,* 4(l), 26-51.

Pepin, Y. (1998) Practical knowledge and school knowledge: A Constructivist representation of education. In M. Larochelle, M. N. Bednarz, and J. Garrisson (eds), *Constructivism and education.* Cambridge: University Press, 173-192.

Perkins, D. (1993) Teaching for understanding: American educator: *The Professional Journal of the American Federation of Teachers*, 17(3), 28-35/1-16. Available at:……. http://www.exploratorium.edu/IFI/resource/worshops/teaching for understanding.html, accessed on 6th August 2009.

Phillips, D.C. (2000) *Constructivism in education.* Chicago: University of Chicago Press.

Pinar, W. (ed.) (1975) *Curriculum theorizing: The reconceptualists.* Berkeley CA: McCutchan.

Posner, G.F. (1998) Models of curriculum planning. In L.E. Beyer and M.W. Apple (eds), *The curriculum: Problems, politics and possibilities.* Albany: State University of New York Press, 173-192.

Rahman, F. (2004) *Analysis of natural science curriculum (chemistry) at secondary level in Pakistan.* Unpublished Ph.D. Thesis, University of Arid Agriculture, Rawalpindi.

Randi, J., and Corno, L., (1997) Teachers as innovators. In B.J. Biddle, Good, T.L. and I.F. Goodson (eds), *International Handbook of Teacher and Teaching.* Netherlands: Kluwer Academic Publishers, 1163-1221.

Saylor, J.G., Alexander, W.M., and Lewis, A.J. (1981) *Curriculum planning for better teaching and learning* (New York: Holt, Rinehart & Winston).

Skemp, R. (1976) *'Relational understanding and instrumental understanding', Mathematics Teaching,* 77: 20-6.

Smith, D.L., and Lovat, T. (1990) *Curriculum: Action on reflection.* Wentworth Falls: Social Sciences Press.

Solangi, S. and Hassan, M. (2004) Changing the individual and the world around her: A case study of female teacher from rural Sindh. In A. Halai and J. Rarieya (eds), *Impact: Making a difference,* Proceedings of an International Conference held at AKU-IED, Karachi, Pakistan, 28-30 August 2003, 345-358.

Thiessen, D., and Anderson, S.E. (1999) ***Getting*** *into the habit of change in Ohio schools: The cross-case study of 12 transforming learning communities.* Toronto: Ontario Institute for Studies in Education of the University of Toronto, Ontario, Canada.

Upadhyay, B., Calabrese, A., and Zahur, R. (2005) Teaching science in a poor urban school in Pakistan: Tension in the life history of a female elementary teacher. *Science Education*, 89(5), 725-743.

UNESCO and USAID (2005) *Donor Support to Education. Lesson learned meeting 23-24 June, 2005*, Islamabad, Pakistan.

University Grants Commission of Pakistan (2001) *Revised curriculum of Pakistan Studies: Curriculum Development Project.* (Islamabad: Ministry of Law, Justice and Human Rights, Islamabad.

Wildman, R.L. (1991) *How secondary school teachers change their classroom practices.* Unpublished doctoral dissertation, University of Toronto.