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**Resource Teachers in Zimbabwe: The Challenges of Becoming a Teacher
Leader While Trying to Change One's Own Beliefs and Practice**

By

Scott R. Johnston

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

DOCTOR OF PHILOSOPHY

Department of Teacher Education

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ABSTRACT

RESOURCE TEACHERS IN ZIMBABWE: THE CHALLENGE OF BECOMING A TEACHER LEADER WHILE TRYING TO CHANGE ONE'S OWN BELIEFS AND PRACTICE

By

Scott Johnston

The professional development of teachers is one aspect of current educational reforms in Zimbabwe. Numerous projects are underway to help teachers improve their teaching. However, there are few studies that closely examine what beliefs and experiences teachers bring to a project as well as what and how teachers learn during these professional development opportunities. This study examines how three practicing biology teachers in Zimbabwe, enrolled in a part-time degree program at the University of Zimbabwe, respond to the project in terms of their own teaching and how they implement the new role of resource teacher.

I came with two specific questions. How do the teachers' prior experiences and beliefs influence their teaching and their work as resource teachers? How do these teachers make sense of what they are introduced to in the project?

I utilized both quantitative and qualitative methods. Initially, all 48 participants answered a questionnaire that asked about their beliefs about teaching and learning. This study focuses on three biology teachers, whom I interviewed, observed teaching in the classroom, and observed organizing and carrying out workshops for other teachers.

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This research found that the beliefs and experiences that the three biology teachers brought to the professional development opportunity influenced what they focused their learning on. While all the teachers learned about changing classroom practice and working with other teachers, they differed in how they thought their SEITT experience affected their classroom practice. For example, one teacher did not change his classroom teaching in the wake of SEITT; another used SEITT to fine-tune his practice; and the third reshaped the organization of her classroom by incorporating group work introduced by SEITT.

The professional development opportunity also prepared these teachers to be teacher leaders. While studying in the project, these teachers led workshops for other teachers in their regions. All three teachers attended to technical aspects of leading these workshops; they followed their schedules and used carefully scripted plans. They carried out the workshop without necessarily thinking about how this helped the learners learn and they avoided any conflict with other teachers. In this way, both working with teachers and students the three teachers' tacit beliefs about learning remained unchanged.

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To my Mom and Dad, who taught me to always do my best at whatever I attempted.

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ACKNOWLEDGEMENTS

This dissertation has its roots in my interest in education in other countries. I started thinking about returning to graduate school while still teaching in Japan in 1990. Since 1993, my life has pretty much revolved around my family and my quest for learning. Many individuals and organizations had a role in helping me complete this tome, as John Metzler, one of my committee members, kept referring to my dissertation. As time passed, I agreed with his terminology.

In Zimbabwe, the Faculty of Education at the University of Zimbabwe accepted me as a research associate and everyone made me feel at home. Ernst Engels, particularly, encouraged me to come to Zimbabwe to carry out my research. Dr. Albert Natsa and Dr. Josephine Zesaguli, two Michigan State University graduates from the doctoral program in education, were valuable intellectual guides. I was very fortunate to have had them both listen to me and provide ideas for my research and analysis.

Thank you also to the participants in the first cohort of the SEITT project. Particularly, I wish to thank the seven resource teachers who allowed me to observe and interview them in their schools.

On my return to MSU in 1998, I became part of a study group of doctoral students. We helped each other with conceptual, writing and emotional problems. While membership in this group changed as some finished their dissertations and others joined, SeiJin Chung and Phone-mei Chou were always available to discuss my tome.

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My dissertation committee also guided me through the years—Professors Jack Schwille, Lynn Paine, Tom Bird, John Metzler, and Teresa Tatto. Jack supported me as I began to think about Zimbabwe as the research site. He nudged me to think deeper and to go beyond some of my simplistic ideas about the research. Lynn, who took a leading role in September 1998, also guided me and continued, as Jack did, to encourage me to think more deeply about my data and ideas. I was very honored to have had Jack and Lynn working with me on my dissertation. During this time, I experienced an educational mentor-mentee relationship that is often sought but that is seldom achieved.

I also want to thank the National Science Foundation for financial support. They provided a Dissertation Enhancement grant through the Division of International Programs to carry out the research in Zimbabwe.

Finally, and most importantly, thanks to my family—my wife Yoko and daughter Tabatha. When I suggested in 1991, while we were living in Japan, that I would like to return to Michigan to study, Yoko supported me even when the original idea of three years stretched to six. Both Yoko and Tabatha have encouraged me to continue the work that I had started. In the last year of writing this dissertation, Tabatha would often say, “Daddy, are you still working on your dissertation?” Now I can answer, “I am finished.”

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LIST OF ABBREVIATIONS

A-level	Advanced level
DSME	Department of Science and Mathematics Education, University of Zimbabwe
HM	Headmaster or Headmistress
INSET	In-service Education and Training
Licentiate	Dual degree in B.Sc./B.Ed. from Cuba
MC	Management Committee
MoE	Ministry of Education
O-level	Ordinary level
PGCE	Post Graduate Certificate in Education. Teachers with only B.Sc. degrees in a subject area need this certificate to continue teaching at A-level.
PGDipScEd (INSET)	Post Graduate Diploma in Science Education (INSET); 2 year part-time
SDA/SDC	School Development Association/Committee
SEITT	Science Education In-service Teacher Training Project
SMC	Science and Mathematics Center
ZIMSTT	Zimbabwe Science Teacher Training Program
ZJC	Zimbabwe Junior Certificate

CHAPTER

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CHAPTER 1 INTRODUCTION: CONNECTING MY PAST TO A QUESTION AND PLACE

The path to my current interest in international models of professional development did not follow a straight line. Nonetheless, it converges around the role of experienced teachers interacting with the purpose of improving their teaching.

My growth follows a path similar to what one of the teachers experienced in Featherstone's (1993) *Learning From the First Year of Classroom Teaching: The Journey In, the Journey Out*. In this process, as I gain experience and reflect back on my own learning and its connection to present practice, I become aware of my own shortcomings and then begin the process of change. This has been my course to understanding my learning and teaching in international situations, and this path has led to an interest in understanding the paths that others follow.

I have lived or taught in China, Japan, the U.S., and Zimbabwe, four very different countries. While living in these countries, I learned many things about my teaching and my views of learning. At the time I was living in China, Japan and the U.S., I did not really try to link these experiences in teaching and learning to a theory or philosophy, not because of a lack of interest, but because it never crossed my mind. At Michigan State University, through reflecting on these experiences and through readings, I began to make sense of my past and how it is intricately tied to my current views of teaching and learning. I found that several issues seem to weave among the experiences and my learning. These

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are prior experiences, beliefs about teaching & learning, and how teachers working together can influence their teaching and thinking.

My Path to Learning

How have these issues influenced me in my own experiences in learning?

One critical incident in China highlights how my prior experiences, beliefs, and interaction with another teacher put me on the path to critique my own learning.

When I went to China in 1987, I had already earned my masters degree in Teaching English as a Second Language and had taught in Japan for three years. I felt fairly confident with my teaching. A critical incident in a classroom challenged this lax attitude. I was teaching a writing class using the textbook, as I had in every lesson before. One student read the story, I asked a few questions and then each student wrote a short essay. This particular assignment was on UFOs, not an everyday topic for these students. As I walked around the class, I suddenly realized that the assignment was meaningless to the students. The writing was a task and not a learning experience. Not only was the topic disconnected from their lives, I had not in any way tried to understand their perspectives. At that moment, I felt disgusted with myself as a teacher. I thought about the classes I had taught during my master's program and how important it was to involve the students. I realized that I was not doing that. I was ignoring **what** I had learned and was teaching like my own elementary, secondary, and **university** teachers had taught me. After this class, I visited an American **colleague**, Mike, and we had a late night "discussion" over a bottle of Japanese **sake**.

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This particular critical incident contains several of the issues that have permeated my professional life. I was an experienced teacher, yet continued teaching drawing on my own experiences as a young student rather than on my professional education. The experiences in my Masters program arose at this time as potentially powerful alternatives. However, I really did not know how to go about teaching the way I had learned in the Masters program. That program offered a view of teaching that was conversation-based, while in this class in China I was teaching writing.

As I now reflect on my experiences in the Masters program and the writing class in China, I realize that I was teaching using strategies without thinking of how students learned. My beliefs about learning did not include creating a classroom atmosphere in which students' experiences and thinking are part of the content of learning.

This Chinese incident also incorporates one other important issue: interacting with colleagues. My late night discussion with Mike represents a teacher reaching out to another teacher. It was the beginning of a collegial interaction with a peer. This talk was essential for me to think about my views on teaching and learning and how I might begin to change. I have a feeling that just the incident, without someone to talk to about it, might not have resulted in my beginning to change. After this talk with Mike, our relationship shifted somewhat. Before this, our conversations were about life in China, our pasts, and places to visit. Now, our conversations often included discussions about teaching and learning. I would like to be able to say that I left China a changed teacher in

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beliefs and in practice. Unfortunately, that did not happen. At this time, I was reflecting on my practice, but I was not sure how to change.

After teaching for one year in China, I went to Japan to teach. In Japan, I continued to confront these issues, both in my classroom and in interactions with other teachers. In my classroom, I started using a process writing strategy in which the topics appeared more connected to the students' lives and in which the students went through drafts. In one class, the topic was "Something Unusual That Happened to Me." Though the topic included the word "Me", that did not guarantee that the assignment was meaningful to the students. In fact, most of the students said, "Nothing has ever happened to me". I realized that I was imposing my view of a learning environment on the students. This environment was meant to create opportunities for students to express their ideas. However, this type of classroom was unfamiliar to them. Changing the classroom environment was not enough. I found that I needed to get to know the students and they needed to get to know me. Then we could ask questions that were important and begin together to learn in our new environment.

This incident helped me realize that teachers' knowledge is more than knowing strategies and content. Teachers' knowledge includes, among other things, learning about the learners. If my goal was to help them learn to write, I needed to bring the students into the process and let them communicate ideas to each other. I needed to create an environment where students were not afraid of expressing their ideas and where I could build on what each student already knew.

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This new concept of teachers' knowledge that I was beginning to embrace was also connected to how teachers worked together. In Japan, I worked with teachers who attended prefectural education seminars. These teachers were committed to improving both their own understanding of English and that of their students. At the seminars, I helped organize four-day sessions in which teachers role-played and learned about new teaching strategies. I facilitated their learning by organizing groups in which they worked together to do projects and other activities. These teachers were enthusiastic about improving their own English and their teaching of English and worked together towards these two purposes. However, I never followed up on these teachers' learning. I did not see them teaching in their classrooms, and I have always wondered if they interacted in the classroom as they did in these groups, or if they lectured. What impact did these sessions have? I did not know.

When I arrived at MSU in 1993 to start my doctoral studies, these issues concerning beliefs about teaching and learning, prior experiences, teachers' knowledge, and perspectives on working together were part of my baggage. They were baggage that needed to be unpacked in order to become areas of inquiry. I needed to examine the literature in order to find out what was already known about my areas of interest and what was not yet fully investigated.

At MSU, I delved into what teaching and learning meant. A class on *Learning to Teach* introduced me to theories of learning. Before this class, I had never heard of social constructivism or Vygotsky. In this class, I began reflecting on my past teaching, and I could identify aspects of social constructivism in my

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teaching. Prior to this, I did not have the names to attach to the learning that I at times promoted.

I began to stick names to some of the issues I was concerned with. Collegiality was connected to how teachers worked together. However, I discovered that working together was not always positive for the participants. Sometimes it was coerced and sometimes it meant sharing stories about "bad" students. I learned that beliefs about teaching were powerful forces that formed a cognitive framework from which decisions about teaching were made.

At MSU, I began to think more deeply about these issues. At the same time, I became interested in investigating the ways teachers teach and learn elsewhere in the world. I particularly thought about doing research in another continent, Africa. I knew that having studied teaching in two continents had helped me understand some differences and similarities in the ways teaching was approached. Examining teaching in another culture could provide me one more perspective for thinking about teaching and its influence on student learning. I wanted to add Africa to my North American and Asian experiences. From a trip to Zimbabwe in 1990, I had learned that Zimbabwe had different types of educational problems, in part, related to the large number of students entering the system since independence in 1980 and to the lack of resources.

I visited Zimbabwe in the summer of 1995 with the express purpose of locating a project in which I could carry out research on teachers trying to change both their beliefs and their ways of teaching. I met the external coordinator of a professional development project and talked with him about my research

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interests. He then invited me to study how the participants in this project were responding to the new ideas of the project.

Back at MSU, I continued to peruse the literature on professional development opportunities, teachers' beliefs and knowledge, and prior experiences. I wanted to link my own overseas experiences about learning with questions that were pertinent to developing countries. I needed to know more about research in these areas before jumping from a Western situation, where most of the literature was produced, to a different context, an African developing country. Hence, I hoped the literature would provide me with a lens on teaching and learning that would not limit my perspectives but that would provide a foundation from which I could begin my inquiry. From my examination of literature on teachers participating in professional development projects, I found that an area that needed more study was how experienced teachers' prior experience and beliefs interacted with a professional development project in a developing country with limited resources and a large student population. Do these teachers' responses to a professional development opportunity play out as they have been found to do in the West?

Conceptual Framework: Learners and Opportunities

Thinking back to my own critical incident in China and from examining the literature, I knew that learning to teach is a complex process. Understanding this process involves looking closely at many aspects of teaching and learning.

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... research in the past two decades has made it clear that learning occurs through an active process of interaction between the learner and an experience. Learners *impose* meaning on the basis of their prior knowledge (p.2).

The learner and the opportunity are closely connected. Often new ideas about teaching and learning are first experienced through a professional development opportunity. I will focus on three aspects of what may influence what and how teachers learn: teachers' beliefs and experiences, teacher knowledge, and opportunities of professional development.

Teachers' Beliefs on Teaching & Learning and Their Prior Experiences

Initially, I had intended to separate beliefs from experiences. However, I soon found that beliefs and experience are too closely connected. Beliefs shape experiences and experiences shape beliefs. In China, my teaching in the writing class drew little on my professional experiences in the Masters program. Rather, I seized more from my personal experiences as a student.

I found that I was not alone in drawing on both my past experiences as a student and my prior experiences teaching. Lortie's seminal work on apprenticeship of observations emphasizes the influence of the enormous number of years spent as students in the classroom (Lortie, 1975). My apprenticeship of observation had a powerful and lasting influence on the way I taught. Like me, all teachers spend years as students. How they were taught, how they viewed knowledge, and how they envisioned their role as students play

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a powerful role in shaping the beliefs and teaching of teachers (Feiman-Nemser & Remillard, 1995).

One reason for this resiliency is that prior beliefs of teachers are often tacit and not easily brought out for examination. These beliefs shape each teacher's actions in the classroom around such ideas as teaching, learning, students' work, testing, and teacher cooperation. These beliefs are very powerful, yet difficult to change (Feiman-Nemser & Remillard, 1995; Kennedy, 1991). Indeed, in my own case in China, I did not think about changing my beliefs. I did not think about my tacit beliefs and how they may have shaped my teaching. Rather I just wanted to change my teaching. Changing my beliefs about teaching and learning was not an immediate consideration. I did not see the connections between beliefs, experience and practice.

Like many teachers, I was giving assignments and expecting my Chinese students to pick out facts from the readings and integrate them into their papers. I would then decide, by grading the paper, if they had succeeded. In this view of teaching and learning, I have the knowledge that I pass on. The learners merely have to listen passively, read the article and then magically write a short essay. In this banking system of education, the teacher passes knowledge on to students who put the knowledge in their heads to use later (Cohen, 1988; Feiman-Nemser & Remillard, 1995; Freire, 1970).

Another view of teaching and learning suggests that the learner holds a more active role in the learning process and the teacher needs to help students connect ideas to the learner's life experiences and beliefs. The learner is not

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assumed to be a bank to be filled with knowledge, but is assumed to be a person with previous experiences and knowledge (Cohen, 1988; Cuban, 1984; Feiman-Nemser & Remillard, 1995). Any new ideas will have to take into account these past experiences and build on them or find ways to challenge misconceptions (Dewey, 1938; Driver, 1983).

This view of learning is often referred to as a constructivism.

Unfortunately, the term "constructivism" has taken on many meanings, depending on the person using the term. However, Tatto (1999) indicates that there are some agreed on aspects of constructivism:

Constructivist views of teaching and learning generally argue that teachers need to know that knowledge is constructed by individuals and their society; they need to be able to construct knowledge themselves in order to demonstrate such an assertion, and they need to make sense of their learning within a sociohistorical context in order to help their pupils find meaning in what they learn (p. 17).

Teachers need to know knowledge is constructed and be able to construct it themselves. Dewey's (1938) concept of educative learning ties into this conception of learning. Dewey links educative learning with experience, "When education is based upon experience and educative experience is seen to be a social process, the situation changes radically. The teacher loses the position of external boss or dictator but takes on that of leader of group activities" (p. 66).

Dewey adds:

But what has been said is organically connected with the requirement that experiences in order to be educative must lead out into an expanding world of subject-matter, a subject matter of facts or information and ideas. This condition is satisfied only as the educator views teaching and learning as a continuous process of reconstruction of experience (p. 111).

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Dewey thus includes both subject-matter and experiences in his definition of educative experience. These experiences are more than just isolated activities. Educative experiences are a reconstruction of experiences by the learner through social processes. Through this expanding development of experience, experience can become educative. I think Dewey is suggesting that an experience can be educative if, first, it is linked to the learner's life. Then the learner can reflect on the experience, analyze and organize the experience into one's current ways of thinking. This will influence the beliefs of the learner. Finally, the learner can use this reconstructed experience when making future decisions or facing new experiences.

However, this reconstruction of experiences and path to educative learning is not so simple. Ball (1996) talks about teachers and how previous experiences are often negative. Ball says:

There is a growing recognition that teachers, like their students, bring with them experiences and prior understandings that profoundly shape their learning. These previous experiences sometimes do not help them as they struggle to enact these new reforms. Indeed, past experiences can often act as obstacles (p. 504).

Research into life histories or biographies helps to illuminate the power of past experiences and their connection to beliefs. Knowles (1992) describes biography as, "Those formative experiences of pre-service and beginning teachers which have influenced the ways in which they think about teaching and, subsequently, their actions in the classroom" (p. 99). Knowles demonstrates that there are both positive and negative influences. Positive influences often drive a

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teacher to teach because of a desire to provide students with learning situations that they experienced as a student. Negative experiences often energize prospective teachers not to teach the same way as they were taught.

There is a potential problem in doing research on remembered experiences, though. This research has been questioned because of how the remembered experience may be different from the actual experience (Little, 1990a). On the other hand, how teachers remember their own experiences may be the source of action rather than the experience itself. Britzman (1994) says:

The primary category of analysis is the discourse of the experience rather than the experience itself. Here, experience does not “tell” us who we are, what we see, and even how to act; we are the tellers of the experience (p. 56).

Hence, teachers' remembered experiences might help us understand how teachers currently make sense of their pasts. For example, Ali (1996), in a study of experienced teachers studying to be mentors in Pakistan, found that these teachers continued to draw on their own early experiences as learners. Dembele (1995), studying two mentors in the same school and how they approach mentoring differently, also found that the mentors drew on their own recollections of their experiences as students as well as their experiences with professional development while teaching. For example, one of the teachers talked about a high school genetics project that started her questioning the authority of books and realizing that science was uncertain. This teacher also suggested that the greatest influence on her changing view of teaching and learning was the interaction with two university faculty members at a nearby university. These

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faculty members mentored her and helped her change from a delivery method to a facilitative way of teaching. This teacher, in her remembered experiences, had powerful incidents as a student and as a teacher.

In China, I began to think about my beliefs about teaching and learning and how my own experiences seemed to influence the way I was teaching. I realized that I was not teaching in an educative way. However, I did not know what alternatives were possible. Thus, though I was rethinking the purpose of teaching, I did not know how to effect this change. I did not think about how beliefs and teacher knowledge are connected as Borko and Putnam¹ (1996) suggest:

To be successful, efforts to support teachers' learning must recognize that teachers' knowledge and beliefs about teaching, learning, learners, and subject matter will play a critical role in determining whether and how they implement new instructional ideas (p. 702).

Teachers' Knowledge

In reflecting on my incident in China, I now realize that my knowledge of teaching writing was limited. In my Master's program in Education, we had talked about using strategies to get students talking and to provide them with facts that they could use. During my critical incident in the writing class, I became aware that I was not using strategies to help my students improve their writing. Rather, I was putting them through the task of writing. As a teacher, I was only going through the students' text and assigning them writing from a list at the end of

¹ I have separated beliefs from teacher knowledge in this dissertation to highlight both of them. Like Borko and Putnam, I believe that beliefs are actually part of teachers' knowledge.

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each story. Although my own view of teachers' knowledge was limited, I wondered what research had to say about teachers' knowledge.

I found several models of teachers' knowledge (Elbaz, 1983; Grossman, 1990; Shulman, 1986). For example, Elbaz (1983) talks about practical knowledge, the knowledge teachers have gained from making decisions in the classroom. Borko and Putnam (1995) propose three domains of knowledge: general pedagogical knowledge, subject-matter knowledge, and pedagogical content knowledge. These domains are drawn from Shulman's work.

Borko and Putnam's three domains of knowledge help us think about what a teacher needs to know to teach and help students learn. These domains include both the content and the process of learning. General pedagogical knowledge refers to a teacher's knowledge and beliefs about teaching, learning and learners that is not limited to one subject. Experienced teachers have spent years teaching and have developed routines for running classes and for teaching. These routines make teaching easier, yet they also can serve as barriers to change (Borko & Putnam, 1996). Once a teacher learns a routine, he/she might not think about why or how to use it. To change at this point involves considering the costs of trying something new. These costs may include time to learn, the risk of not succeeding, and feelings of inadequacy if failing.

In my case, since I felt so disappointed with my teaching, I could only benefit from trying something new. I was dissatisfied with myself as a teacher and wanted to change the way I taught. I was not thinking of writing or conversation classes specifically, but of a broader view on learning. I wanted to

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change the form of my class and add activities--any activities. Here I was thinking of changing my general pedagogical knowledge.

Subject-matter knowledge includes knowledge of content, substantive and syntactic knowledge (Borko & Putnam, 1995; Feiman-Nemser & Remillard, 1995; Shulman, 1986). Knowledge of content includes the knowledge of facts and concepts in the area. Substantive structures are the explanatory frameworks that influence the organization of knowledge within a discipline. For example, in China I was teaching writing as a part of English as a Second Language. My understanding of the paradigms in this area was, unfortunately, limited. During my Masters program, most of the focus had been on facilitating conversation. I had learned many strategies to facilitate learning; however, I knew very little about process writing and connecting writing to students' lives.

Similarly, my knowledge of the syntactic structures of writing was limited. Syntactic structures are the "canons of evidence and proof that guide inquiry in a discipline" (Borko & Putnam, 1995, p. 45). Since my study at the Masters level was on facilitating conversation, I knew very little about how writing in English as a Second Language had evolved. I was not familiar with research into writing and was not aware of alternative perspectives on how writing is learned or on how to teach writing.

My Masters program had not prepared me to teach writing in ways that drew on my knowledge of how students learn writing. This is pedagogical content knowledge, the knowledge about how a topic within the subject area can be organized and presented to the students. Shulman (1986, p. 9) suggests

numerous ways that a teacher can connect the topic to the students' own knowledge: " ...the most powerful analogies, illustrations, examples, explanations, and demonstrations--in a word, the way of representing and formulating the subject that make it comprehensible to others."

In China, my use of pedagogical content knowledge was limited. I did not make the writing come alive and important to the students. Indeed, I did not know how to connect the writing to the students' lives. Though I had studied teaching English as a Second Language in graduate school, I had learned strategies for getting students to talk. I did not have powerful illustrations and did not know how to use strategies to promote the learning of writing. I did not know or think about the questions to ask the students. I had reverted to teaching the way I had been taught as a youth.

This suggests that there is a very complex relationship between pedagogy, teachers' knowledge and the teachers' beliefs about teaching and learning. The teacher's beliefs, experiences and knowledge about teaching are core aspects of the teacher as a learner. This is what the teacher brings to his/her teaching and to learning. As Ball (1996) says:

What teachers bring to the process of learning to teach affects what they learn. Increasingly, teachers' own personal and professional histories are thought to play an important role in determining what they learn from professional development experiences (p. 501).

The professional development experiences are opportunities for teachers to continue their learning. What teachers learn or decide to learn is shaped by

what they bring to the opportunity and the form and content of the opportunity.
What is learned involves an interaction between the learner and the opportunity.

Professional Development Opportunities

Professional development opportunities usually are occasions to be introduced to something new or to think about the old in new ways. It may result in the teacher changing his/her teaching or beliefs if the innovation fits with the teachers' beliefs and practice. When thinking about professional development projects, we need to consider the learner's concerns at that time as well as how the innovation is presented.

Teachers' concerns

Hord (1987, p. 31) present one model of stages of concern about innovations (Table 1.1). In this model, teachers at level 0-2 are more concerned with how the innovation will affect them. The expressions of concern are statements that a teacher might talk about. As the table indicates, one teacher might consider, "How will using it [the innovation] affect me?" at stage 2. At stage 3, a teacher would be more focused on the task and carrying it out. At stages 4-6, a teacher would be thinking about the impact of the innovation on the students' learning.

Table 1.1 Stages of Concern

STAGES OF CONCERN	EXPRESSIONS OF CONCERN
6. REFOCUSING	I have some ideas about something that would work even better.
5. COLLABORATION	I am concerned about relating what I am doing with what other instructors are doing.
4. CONSEQUENCE	How is my use affecting kids?
3. MANAGEMENT	I seem to be spending all my time getting materials ready.
2. PERSONAL	How will using it affect me?
1. INFORMATIONAL	I would like to know more about it.
0. AWARENESS	I am not concerned about it.

Though stage models tend to suggest "either-or" situations in one dimension, they do provide a format to think about teachers and their responses to some factor, in this case, innovations. Thus, a stage model of concerns for innovation, in conjunction with other information on the teachers participating in professional development projects, can help us understand the teachers' responses to an innovation and the project through which the innovation is introduced.

Professional development opportunities: Form and content

Two common aspects of programs discussed in the literature on professional development opportunities are the form and substance (Ball, 1989; Borko & Putnam, 1995; Kennedy, 1998).

Borko and Putnam (1995, p. 58) suggest that successful professional development projects consider both substance and process. Substance involves growth in two areas: growth around the subject matter and pedagogy as well as

growth in learning about the educational reform efforts. Borko and Putnam say about the process, "...a project's assumptions about how teachers learn should be compatible with its assumptions about how students learn" (p. 58). The authors provide an example of a project based on constructivist ideas:

"Professional development should provide opportunities for teachers to construct knowledge of subject matter and pedagogy in an environment that supports and encourages risk taking and reflection" (p. 58).

Kennedy (1998), however, researched several science and mathematics professional development opportunities and suggests that the forms of inservice projects have been given more emphasis than the content. Kennedy argues that the content of the opportunity may be more important than the form. "Based on the studies I was able to review, it looks as if a case can be made for attending more to the content of inservice teacher education and for attending less to its structural and organizational features" (p. 21).

While the form and content of programs is a division that does allow researchers to examine programs, sometimes it creates an artificial separation. For example, Loucks-Horsley (1998) suggests that effective professional development experiences for science and mathematics teachers includes opportunities to model strategies that teachers will use in their classrooms and opportunities to build a learning community. Modeling strategies in the class and building learning communities can be both the form and the content of a professional development opportunity. Thus, when examining how the learner interacts with a learning opportunity, it is important to keep in mind not only what

knowledge and skills the learner brings but also how the opportunity is organized and presented.

However, most of this literature on teachers and their continued learning opportunities comes from the West. I was interested in the interaction of learners and opportunities to learn in a non-Western country. How does the historical context of the country influence the learning? What role does the examination system play in influencing the learner? What other factors may play a role in influencing the professional development opportunities and the use of innovations?

This research was carried out in Zimbabwe, a developing country. However, all developing countries do not have the same historical, social and educational factors influencing teachers and their development. In the case of Zimbabwe, some important factors are its colonial past, the examination-oriented education system, the lack of resources to improve the educational infrastructure, and the role that non-governmental organizations (NGOs) play in helping the country. In my study, a donor agency funded and supported a project that aimed to help experienced science and mathematics teachers to become resource teachers, teachers who would help other teachers improve their teaching.

Before considering the specific questions asked in this study, more discussion about the context of teaching and learning in Zimbabwe is necessary. We need to learn more about the country's history and educational system because these factors influence what teachers bring to their work in terms of beliefs, knowledge and experiences. What follows is a basic description of some

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factors in the educational system that are particularly important to this study. In a way, this is a balancing act in an attempt to provide sufficient information in a limited space.²

Zimbabwe: Context of Teacher Learning

In this section, I provide a background of some essential elements of the educational system in Zimbabwe as it relates to my questions. This includes historical background on the educational system, information on the ways schools are organized, an explanation of the paths to becoming a teacher, and information on the A-level examination.

Educational History

All of the teachers I worked with were Zimbabweans who had attended some school before independence in 1980. If prior experiences and early beliefs about learning help shape the way teachers teach, then it is necessary to examine the forms of education before independence as well as after.

One aspect of education common throughout pre-independence was that the education for blacks was quite different than for whites.³ Education was free

² Although I limit my discussion on the country of Zimbabwe as the context for this study, I did examine literature on education in Zimbabwe as well as Zimbabwe's history. Dorsey (1991) provides information on the format of education in Zimbabwe. Mutumbuka (1986) discusses past science education initiatives in Zimbabwe. For more information on educational reform in southern Africa, see Mungazi & Walker (1997). Zvobgo has written two books on issues influencing educational change in Zimbabwe (Zvobgo, 1994a; Zvobgo, 1994b). In addition, the Shona culture is important in considering how teachers respond to changes in the way teaching and learning are carried out because the school is part of the society. For example, Shona society is patriarchal and this can influence relationships between learners. Several books that relate to this are Bourdillon, 1987; Bourdillon, 1993; Gelfand, 1979 (reprint 1992); and Shumba, 1995.

³ I use the word "blacks" to talk about the native Africans. In my readings on Zimbabwe, this term along with Africans are the more common words used.

and compulsory for whites, whereas education was neither free nor compulsory for non-white children. Welle-Strand (1996) says:

One system was for the white children and aimed to prepare them for their predetermined status in life, i.e., to be masters and employers. The other system was for the African children, aimed at preparing them for a life as servants (p. 62).

In the early years of education in Zimbabwe (starting from the late 1900s), the main aim was to provide blacks with minimal skills. Until around 1910, primary schools emphasized basic literacy and numeracy as well as some "industrial training" in things like woodworking and agricultural skills. It was not until the late 1930s that there were secondary schools in Zimbabwe for blacks. Prior to this, black students went to South Africa for secondary education (Zvobgo, 1994b).

In 1962, just before the Unilateral Declaration of Independence on November 11, 1965, implementation of major changes began. The responsibility of African education shifted from the central government to new local councils. By shifting responsibility to councils, the government could put less money into education, while maintaining control through new laws. Furthermore, there was a move from academic to vocational training at the secondary level.

Secondary education for blacks was reorganized in 1966. The F1 academic system for a limited number of students and the F2 vocational system were introduced and remained in place until 1980. In this system, 12.5 percent of primary students were allowed to start academic secondary education (F1) while 37.5 percent could attend F2 vocational secondary schools (Zvobgo, 1994b, p.

72). Zvobgo (1994b) suggests that a stigma was attached to this F2 Vocational system. The council that created this system implied that, "The F2 system was intended for children of less academic ability infuriated pupils, parents, and teachers" (p. 72). Parents were also aware that employment for these F2 graduates was limited. As a result, parents did not want to send their children to the F2 schools, and this system never really was accepted by the population.

Reducing this inequality in education for blacks was one of the aims of the fight for liberation. After independence, the new government took measures to open up education to all people. Enormous quantitative changes occurred in the educational system (Zimbabwe, 1993). Free education was provided at the primary level. Chung (1988) says:

Primary school enrollments increased from 819,000 in 1979 to 2,229,000 in 1985; secondary school enrollments increased even more dramatically from a mere 79,000 in 1979 to almost half a million in 1985, a six fold increase (p.121).

This increase meant that a large number of teachers were needed. Many of these teachers were unqualified (Zesaguli, 1994).

At the same time that these efforts to increase access to schooling for the young were moving forward, there were drastic attempts by some people to change the educational system away from pure academics to an education-to-work system. This was opposed by many groups, including parents, schools, and teachers (Jansen, 1991; Maravanyika, 1991). Maravanyika suggests that parents did not want a transformation in education from academic to preparation for work. They still had memories of the F2 system. Rather, parents wanted their children

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to have the education that whites had originally been afforded. Thus, they hoped for what was called a "radicalization" in education, in which their children would receive the same academic education as the whites had received.

Though a transformation in the educational curriculum did not occur, a drastic increase in the number of students did transpire. Before independence, only a limited number of black Zimbabweans followed the academic path, but after independence the number of students hoping to follow the academic path skyrocketed. This increase in the number of students occurred in a school structure very similar to the one that white students had experienced before independence.

Schooling Structure

The pre-independence educational structure, punctuated with examinations at key points, is still intact today (Chung, 1988). Schooling in Zimbabwe consists of primary schooling from first to seventh grades (Table 1.1). Secondary education is divided into two parts: lower secondary from Form 1-4, which is referred to as Ordinary Level (O-level); and upper secondary which is two years of Form 6 and is known as Advanced Level (A-level) (Dorsey, 1991).

After primary school, students enter lower secondary. At the end of Form 2, students take a test for the Zimbabwe Junior Certificate (ZJC). This test does not significantly influence which students continue to Form 3 and 4. At the end of Form 4, students take the O-level examinations. The results of these tests are used in determining whether the students can go on to A-level (See Table 1.2).

At the end of A-level, the students take another test that is central in selecting who can enter the university as well as other colleges.

Table 1.2 School Structure and Grade Levels in Zimbabwe

<i>Primary grades 1-7</i>		
<i>Secondary</i>		
<i>Form 1, Form 2</i>	<i>Zimbabwe Junior Certificate</i>	<i>(ZJC)</i>
<i>Form 3, Form 4</i>	<i>Ordinary level</i>	<i>O-level</i>
<i>Form 6 (lower)</i>	<i>Advanced level</i>	<i>A-level</i>
<i>Form 6 (upper)</i>	<i>Advanced level</i>	<i>A-level</i>
<i>Teachers College</i>	<i>Four years</i>	
<i>University</i>	<i>Three years</i>	

This table depicts the structure of schooling, but it does not tell us about how the O-level examination serves as a gatekeeper in to A-level. The Education Report for 1993 (Zimbabwe, 1993) provide data on students in 1990, and this highlights the drop in student numbers from the last year of O-level to A-level (Table 1.3)⁴.

Table 1.3 Enrollment and Promotion Rate

Grade	Enrollment	Promotion rate 1988-89	
Primary School	2,085,000		
		Male	Female
Form 1	200,700	89	85
Form 2	184,200	90	86
Form 3	153,600	93	88
Form 4	117,100	8	5
Form L6	7700	89	83
Form U6	7000		

⁴ The table draws on pages 18 and 27 of the Report.

This table clearly illustrates how the O-level examination serves as a gatekeeper to the A-level. The number of students fell from 117,100 at Form 4 to 7700 at Form L6, the first year of A-level. Students who do well on the A-levels have a good chance of entering the University of Zimbabwe or other higher education institutes. Students who are not accepted at these higher education institutes may apply to teachers training colleges, vocational institutes, or to college and universities overseas.

In addition to this structure of education, there are a few other aspects of education in Zimbabwe that may influence what teachers bring to their teaching in terms of prior experiences and beliefs. These include the type of schools they attended, the teacher's qualifications and the syllabus of the A-level examination.

School Types and Operation

Schools in Zimbabwe vary in their type of governance. School types include mission schools (church), independent schools, government schools, and district schools. Church organizations opened many schools during the colonial period and continue to operate those schools (Natsa, 1994, p.33). Parents pay high tuition rates and fees for their children to attend these schools.

Independent schools are run by private foundations (Natsa, 1994). Many of the independent schools charge high fees and, in this way, restrict the entrance to families with high incomes. They have good facilities and resources.

I could not find articles that compared the types of schools; however, through conversations with teachers, I discovered that church-run schools and

independent-run schools are perceived as having more resources than the other types of schools. Because of these perceptions, these types of schools are viewed as better places to work.

Government and district schools often have fewer resources. Government schools can be divided into three groups (Dorsey et al., 1991 p. 24). These are government urban schools in what are called low-density areas or Group A schools; government urban schools in so-called high-density suburbs also called Group B schools; and government rural schools. The low-density schools were for white students before independence. These schools tend to have more facilities than the high density schools, though they may not have been kept up since the early eighties. The high density schools were built for blacks and were usually basic structures with few resources. The government rural schools also have very limited resources and are located in the rural areas where resources are low and, often, the financial resources of the parents are limited.

The district schools are run by local authorities. The majority of the district schools opened after independence in order to accommodate the increase in students. These often have few resources.

Natsa says (1994), "School quality differs according to the type of authority running the school. On the one extreme, there are the high-fee paying schools... and on the other extreme, there are local authority schools called district council schools that opened after 1980" (p. 33). The schools that charge higher fees or have church organizations to support them have more financial resources to purchase equipment and to keep the schools operating.

The financial operation of all the schools is in the hands of School Development Associations (SDAs), School Development Committees (SDCs), and donor agencies. The SDAs and SDCs are parent organizations at the school. One is for government schools and the other for non-government schools. These organizations help with the provision of equipment, building maintenance and construction.

While schools are responsible for their own upkeep and expansion, the central government is responsible for paying all teachers' salaries, regardless of school type. Schools can, with permission of the Ministry of Education, provide additional incentives and benefits to the teachers. Many independent and mission schools, which have the financial resources, do add benefits that make these schools more attractive for teachers.

Teacher Qualifications

When examining teachers in Zimbabwe, it is also important to consider where they learned to become teachers. Different types of institutions may provide very different experiences for the professional education students. Teachers who want to teach at primary or O-level normally attended teachers training colleges. When the focus is on A-level science or mathematics teachers, the paths are varied. In order to teach A-level science or mathematics in Zimbabwe, teachers need either a Bachelor of Science degree with a Post-Graduate Certificate in Education (PGCE), a Bachelor of Education degree (B.Ed.), or a licentiate from Cuba (Engels, 1994).

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Data on the percentages of teachers with the different academic qualifications was hard to come by. I searched but was unable to find official numbers of the qualifications of teachers at A-level. I located some unofficial numbers in a project document for the Science In-service Teacher Training project (SEITT); however, as the reader will notice, they do not add up to one hundred percent. Nonetheless, they do provide a general idea of the percentages of teachers with different qualifications teaching A-level. The document indicated that there were about 640 A-level teachers in mathematics, chemistry, biology and physics, then added:

With respect to academic qualifications, 40% are B.Sc. and BscHons graduates, 21% are B.Ed.(Sc.) degree holders, 7% have a Masters degree, 10% hold degrees from Cuba (B.Ed., Licentiate), and 13% did not indicate their degree (Engels, 1994 p. 7).

This quote indicates that teachers with B.Sc. and BscHons qualifications make up a large percentage of teachers at A-level in the sciences and mathematics. These teachers obtain a Bachelor of Science degree from a university in Zimbabwe or another country. These graduates of universities can teach at A-level, but if they plan to remain in teaching for many years, they also need to obtain a Post Graduate Certificate in Education (PGCE) from the Department of Science and Mathematics Education (DSME), University of Zimbabwe. Without a PGCE, teachers are not qualified to remain in the teaching professions. These teachers, who have earned a B.Sc. degree, have studied subject content in their area in a university, but they do not have course work in teaching methodology. The PGCE, which aims to fill this gap, can be either a

one-year full-time course or a two-year part-time course. The forty percent with B.Sc. and BscHons indicated in the above quote would also include the teachers with the PGCE. However, from this quote, we do not know how many had actually earned the PGCE.

The teachers who decide to earn a B.Ed. degree have already earned a teaching certificate from a teachers training college in Zimbabwe. After teaching for at least two years, they can apply to the B.Ed. program at the University of Zimbabwe. The B.Ed. prepares these certified O-level teachers to teach through A-level. These are teachers in biology, chemistry or physics. The B.Ed. degree program was part of the Zimbabwe Science Teacher Training (ZIMSTT) Program. ZIMSTT was implemented in 1985 to up-grade experienced O-level science teachers to teach through A-level and to introduce these teachers to advanced content in a science subject (Zesaguli, 1994). Originally, the course was one year intensive, but then it was changed to two years after an evaluation. ZIMSTT was funded from an outsider donor until 1992, when it was embedded into the DSME at the University of Zimbabwe.

Another path is through studying in Cuba. This program was initiated in the late eighties to help alleviate the shortage of science and mathematics teachers in Zimbabwe. The licentiates received scholarships from the Zimbabwe government to study science or mathematics teaching in Cuba. These licentiates studied Spanish in Zimbabwe for six months and studied in Cuba for five years with the last year teaching in a class. There appears to have been little research carried out on these teachers and their learning experiences. Indeed, most

people I talked to who had not been in the program knew very little about it. This Cuban program recently ended and a new Science and Mathematics Education university, which is part of the University of Zimbabwe, is currently operating in Bindura, a town north of Harare (conversation with Dr. Zesaguli).

From the above explanation, it is clear that the professional education of teachers at A-level science is diverse in Zimbabwe. There are teachers trained in Cuba, teachers who went through teachers training colleges, teachers who attend the University of Zimbabwe and then earned a PGCE, as well as teachers who earned bachelor of science degrees overseas and then returned to earn the PGCE.

Just as there are few data on academic qualifications, there is also little information on the learning opportunities in most of these programs. Knowing how these different programs view learning and teaching and how they teach the teachers would be helpful to understand the experiences, beliefs and knowledge of teachers in Zimbabwe. We do know a little about teacher training colleges. Nagel (1992), who did research on them, argues that the teaching in teachers training colleges is very teacher-centered. This means that the teachers who participated in the B.Ed. program had teacher-centered experiences.

I was unable to locate research on the views of teachers who earned the PGCE at the University of Zimbabwe or who studied in Cuba. In my interviews with teachers holding the licentiate, PGCE, and B.Ed., the teachers indicated that the teaching in these programs was lecture-based, with the focus on the course examinations. Thus, despite the diverse experiences, the professional education

of most A-level science teachers appears to be quite teacher-centered. While the qualifications were diverse, the syllabus that elaborated what the A-level students needed to learn was quite explicit.

Syllabus and Examinations

Although the O-level examination was localized in 1993 and was written and marked in Zimbabwe, the A-level syllabus and examination remained products of the Cambridge Schools Examination Board in the United Kingdom (Chigwedere, 1996). A-level textbooks were still, to a high degree, published in the UK.

The results of the A-level examination are key in determining which students proceed to the University of Zimbabwe and other higher education institutions. The A-level syllabus outlines what students need to learn and also provides information on the content and form of the A-level examination. Since this study focuses on A-level biology teachers, information is provided on the biology syllabus and examination. The following information comes from the University of Cambridge Local Examinations Syndicate's Examination syllabi for 1998 (International Examinations) for the Biological Sciences (1998). The introduction to the A-level biology syllabus states:

The syllabus places emphasis on the application of Biology and impact of recent developments on the needs of contemporary society.

All candidates following this syllabus should be encouraged to:

Use secondary sources of information;

Use information technology (IT) to analyze, store and retrieve data and to model biological phenomena:

Communicate biological information orally, as well as in writing (p. 59).

The syllabus also identified the core and optional categories of biology. The core syllabus included ten sections and suggested that it will take "up to 135 hours of teaching time" (p. 62). The core sections were cell structure, biological molecules, enzymes, cell and nuclear division, genetic control and inheritance, inherited change and evolution, energetics, ecology, transport, and regulation and control. There were five options. Each option could take up to 45 hours of teaching time. The options were biodiversity; applied plant and animal science; applications of genetics; growth, development and reproduction; and human health and disease. A candidate was assessed on two of them.

This document also elaborated on the A-level examination and types of knowledge addressed on it. The examination was composed of four separate compulsory exams and one optional. Table 1.4 depicts the papers, time, and weight (p. 61).⁵

⁵ The papers for the examination are 1,2,3,6, and 0. There do not seem to be papers numbered 4 and 5.

Table 1.4 Scheme of Assessment

Paper	Description	Duration	Marks	Weighting
1	Structured questions (may include data response and comprehension) and free response questions	2.5 h	100	35%
2	Multiple Choice	1 h	40	15%
3	Short answer questions and a free-response question	1.5 h	75	30%
6	Practical examination	2.5	60	20%
0	Special Paper	2.5	75	

The whole test encompassed ten hours. Paper 1 covered the two option topics while the remaining examination papers covered the core topics. The syllabus also indicated that three categories of knowledge were covered on the examination. Papers 1,2, and 3 included knowledge and understanding as well as application of knowledge and understanding. Paper 6 demonstrated the students' experimental skills.

I could not find the examination for this year's scheme, but I did locate the examination and marking scheme for 1996. The practical examination emphasized following directions, using equipment, and observations. For example, in Question 1, the examination provided the procedure to prepare solutions. It used such phrases as set up, label, add, and stir. Then the students were to observe the reaction and write what they saw (University of Cambridge, 1996, p. 2).

This organization of a practical examination seems typical of the UK (Tamir, 1996). Tamir (1996) examined and compared examinations in several countries. Tamir found that most of the countries did not even use a practical

examination. Tamir states that the practical examinations in England/Wales emphasized the manipulation of equipment, routine procedures and simple information. This was in contrast to Israeli practicals, which were inquiry-oriented and required higher-level skills (p. 68). Tamir says of the A-level biology examinations as a whole for England/Wales: "Questions tended to address simple rather than complex information but employed many, varied graphical devices to do so" (p. 84). The organization of the A-level biology examination in Zimbabwe appears to be similar to these examinations. The practical examination required procedural skills, and the other parts of the examination attended to simple rather than complex information.

Summary

This brief discussion on education in Zimbabwe highlights both differences and similarities within the country. The educational system remains similar to what the whites received before independence. It is still very much based on the British system and, at A-level, the examinations continue to be devised and marked in the United Kingdom. There are many different school types with the independent and church schools often having more resources than the other types. The paths to becoming an A-level teacher are also diverse.

Hence, we find some possible differences and some similarities among teachers at A-level. If they went through the education system in Zimbabwe, they passed through the examination-oriented system that has been the educational structure in Zimbabwe since before independence. In addition, A-level science

teachers have numerous paths to learn to teach. Though these experiences may differ, the message was often transmitted through lectures.

Arriving at the Questions

When thinking about the questions to research, I knew that I needed to link my own interests in what teachers bring to learning opportunities to what is known in the current research literature. I wanted to examine how and why teachers may change their teaching by participating in a project and how teachers' past experiences and beliefs may influence such changes.

My interest in how and why teachers learn has remained central to my research interests; however, the actual questions that I researched were different from the questions I took to Zimbabwe in 1997. When I arrived in Zimbabwe, I had planned to observe these teachers, known as resource teachers⁶, participating in the Science In-service Teacher Training project (SEITT), and assisting other science teachers at Science and Maths Centres (SMCs). These are centers that the SEITT project established in the regions at A-level schools. In most cases, a school provided one room in which resources, such as textbooks, journals, a copy machine and a computer would be stored. The resource teachers were also expected to organize regional workshops to support the improvement of A-level teaching in each region. I had hoped to examine how the SEITT resource teachers interacted with other teachers at the SMCs and how their prior experiences and beliefs influenced these interactions.

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When I arrived in Zimbabwe in 1997, these SMCs were not yet operational. I had to rethink my research questions. I did not immediately develop specific new questions. Rather, I decided to learn more about the teaching and learning of some of these resource teachers and then develop the research question. The questions that began to take shape were: How do these teachers, enrolled in a professional development project that prepares them to facilitate the learning of other A-level science and mathematics teachers, respond to the project in terms of their own teaching and how they implement the new role of resource teacher? How do they teach and why? What do they learn and how in the project? What do they decide not to learn? How do their prior experiences, beliefs, and teacher knowledge influence how they respond to the project and their own teaching? How do these teachers' learning in the professional development opportunity compare to what we know in developed countries?

In organizing a dissertation, decisions of priority must be made. I decided to arrange the dissertation chronologically because the participant's path through the project is chronological. Chapter One has several purposes. It introduced me, the researcher, and identified issues surrounding teaching and learning that I continue to try to understand. It links these issues to other research to build my conceptual framework, and it suggests that what teachers bring to a learning opportunity interacts with that opportunity.

⁶ The resource teachers at the time of this study were part-time students at the University of Zimbabwe. Throughout this dissertation, it should be understood that they had not yet received their diplomas.

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This chapter also grounds the research questions in a professional development project in Zimbabwe, a developing country. Chapter Two delineates the research process. Chapter Three introduces the project and the participants. Chapter Four, Five and Six present three resource teachers. These chapters examine the teachers' practices, beliefs around teaching, and how they respond to the project. Finally, Chapter Seven analyzes what can be learned about opportunities to help teachers improve their teaching and take on new teacher leader roles.

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CHAPTER 2 PATH OF INQUIRY

How a researcher conceptualizes questions and views the process of inquiry has a great impact on how the research is eventually carried out. My questions address how teachers think about teaching and learning both in their classrooms and in a professional development project. My research also examines teachers' teaching in classrooms and learning in an in-service project. The scope of the research necessitated collection of data from multiple sources.

In my research, I chose a design that drew on quantitative and qualitative methods. This not only allowed me to acquire a great deal of data, it also provided in-depth data. Like many researchers, before I left for Zimbabwe I was very concerned with whether I would collect enough data of importance.

When organizing this research, I was also concerned about my personal biases. As a researcher going to another country and another culture, I had concerns about my background as a Westerner. Because I had lived in other countries and was well aware of stereotypes and biases people have towards others, I knew that I would be analyzing how others made sense of teaching through my own perspective. How would my past experiences focus me on some aspects of the research and blind me to others? How would I handle this? How would I approach my own biases? Hammersley and Atkinson (1983) indicate that, "Reflexivity has implications for the *practice* of social research too. Rather than engaging in futile attempts to eliminate the effects of the researcher, we

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should set about understanding them...” (p. 17). Indeed, in qualitative research the role of the researcher is, “...the research instrument *par excellence*” (p. 18). Thus, I decided to keep in mind the influences that my education in the US, my nine-year experience teaching in Japan, and my experiences in China might exert on all aspects of the research. These had, to an extent, been the source of motivation for this study and would influence what I saw, what I consciously and unconsciously decided not to see, and how I interpreted the data. Rather than denying these perspectives, I believe that they added insights to my understanding of the professional development of the teachers in this study.

Keeping in mind these cultural concerns, I organized the research. This chapter provides the details on how I gained access to the field, how I designed the research and collected data, and how I analyzed that data.

Gaining Access: A Predissertation Trip in 1995

I have already discussed why Zimbabwe was the site of this research. However, interest alone does not open doors. There were a great many doors to open in order to carry out research in Zimbabwe. First, I had to apply through the University of Zimbabwe to the Zimbabwean government for permission to do research there. The University of Zimbabwe accepted me as a research associate in the Department of Science and Mathematics Education (DSME). Dr. Josephine Zesaguli, a graduate of Michigan State University, College of Education, and a faculty member in the DSME at the time I applied, was my sponsor. The Research Council of Zimbabwe then granted me a Research Permit and a temporary employment permit.

When applying for this permit, I indicated that I would need access to the following institutions: Ministry of Education, the University of Zimbabwe, and the Science and Maths Inservice Teacher Training Project (SEITT). In addition, I also asked for permission to interview individuals affiliated with these institutions and with teachers participating in the project. Once I arrived in Zimbabwe, I asked all nine regional directors for permission to do research in their districts, I asked the heads of the schools where I observed and interviewed for their permission, and I asked the teachers for their permission to do my research. These layers of permission were needed prior to carrying out my research.

Research Design

This research examined beliefs, teaching practice, and professional development opportunities in the context of a developing country. Because I first wanted to become more familiar with teaching in Zimbabwe and the project, I used a design that allowed me to start by exploring the Zimbabwean context, then moved to learning about the participants in the project, and in the end, focused on a few participants (See Appendix B for a schedule of the year-long research). My research format (Figure 2.1) was based on a design that Miles and Huberman (1994) presented:

[It] alternates the two kinds of data collection [qualitative and quantitative], beginning with exploratory fieldwork, leading to the development of a quantitative instrumentation, such as a questionnaire. The questionnaire findings can be further deepened and tested systematically with the next round of qualitative work (p. 41-42).

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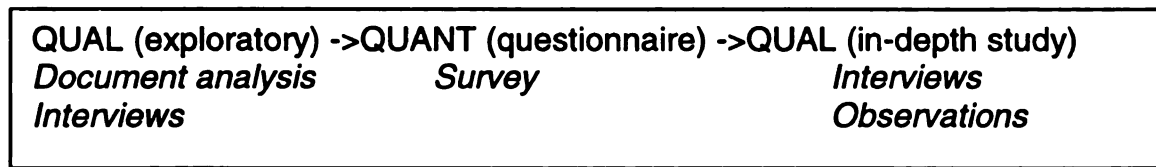
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Figure 2.1 Research Design



This shift from qualitative to quantitative and back to qualitative allowed me to start my research slowly and begin to focus. As I elaborate below, in the exploratory phase, I learned about the project and A-level teaching through readings and interviews with teachers and SEITT staff. The questions that this exploration raised were included in a survey that I gave to all the resource teachers in their third residential period. The results of this survey helped me discern the variation among this group of A-level teachers and aided in my selection of cases to pursue in-depth. The subsequent interviews and observations provided data that allowed me to paint portraits of three resource teachers, their thinking about teaching and learning, their actual teaching, and their ideas about their new roles as resource teachers.

Discovering the Context of Learning: Exploratory Fieldwork

When I arrived in Zimbabwe in early 1997, I began to explore what A-level learning and teaching encompassed and how the SEITT project aimed to influence this practice. The exploratory aspect of this research involved reading and observations for two purposes: (1) to gain an understanding of SEITT's goals and processes, and (2) to gain an understanding of the context of A-level teaching through observations in some classes and interviews with teachers concerning teaching and other responsibilities.

Soon after arriving in Zimbabwe in January 1997, I read SEITT project documents, participants' assignments, and information concerning the content of the residential periods. The SEITT documents included project reports, regional visit reports, and residential period teaching materials. I also carried out informal talks with SEITT staff to learn about the progress of the project, the staff's views towards the participants, and other parties involved in the project, such as the Education Officers in the regions.

In addition to learning about the project, there was a need to learn about the context of teaching at A-level. Though there is published research on education in Zimbabwe, there is very little published in the realm of A-level teaching in the science or mathematics classroom⁷. An exception is Zesaguli's (1994) doctoral dissertation. Thus, it was necessary to visit some A-level science and mathematics classes to gain an insight as to the nature of A-level teaching and the responsibilities of teachers.

I observed three A-level teachers teaching a few hours in their classrooms and followed this with informal interviews concerning the class and the teachers' other responsibilities in the school. For two of the teachers, I was able to visit multiple times, while for one I was only able to visit one day. These visits and interviews helped me to understand better the context of A-level teaching and the teachers' responsibilities.

⁷ Some research results on education in Zimbabwe can be found in the volumes of Zimbabwe Journal of Educational Research. Natsa (1990) also looked closely at Shona and English teachers in secondary schools.

Teachers' Views of Teaching and Learning: Questionnaire

My exploratory research provided some background on the SEITT project, its goals and the teaching context at A-level. However, I wanted to learn more about how the group of teachers participating in SEITT thought about teaching and learning science, about working with other teachers, and about their future plans. I also planned to use the responses to help select teachers for the qualitative research. I devised a questionnaire that asked the teachers about their views of teaching/learning and their expectations of their new roles as resource teachers. (See appendix C for the full questionnaire.)

This questionnaire was developed using the materials in *A Study Package for Examining and Tracking Changes in Teachers' Knowledge* (Kennedy, Ball, & McDiarmid, 1993) as a guide.⁸ All forty-eight prospective resource teachers were given the questionnaire to complete at their residential period at the University of Zimbabwe in May 1997. Forty-two resource teachers returned the questionnaire for an eighty-eight percent response rate. The response data were analyzed using frequencies and percentages. In addition, the demographic information for the six teachers who did not complete the questionnaire was obtained from those teachers at the next residential period. Thus, I had demographic information for all the teachers.

I reported on the findings of the survey in a Zimbabwean journal in order to provide the educational community with information on the SEITT participants

⁸ This study package was developed by the National Center for Research on Teacher Education and included an interview, observation guide, and questionnaire. It was developed for teacher education program planners and

as a group (Johnston, 1997). The findings provided demographic information on these A-level teachers as well as some information about their beliefs on teaching and learning. In the next chapter, some of the information from the survey is discussed.

Selection of Teachers

As indicated above, the survey played a role in the selection of teachers for in-depth study. Selection depended, in part, on their answers to the survey's questions on learning. As I will elaborate later in this section, originally I had selected seven teachers to study. I collected data on all of these teachers. However, I had more data on the three biology teachers and this study centers on them. Table 2.2 depicts this selection process and the data on the different teachers.

Initially, I had hoped to have the SEITT staff identify two groups of teachers: those changing as a result of participating in the project and those resisting change. However, as I have already indicated, the SMCs were not operating and the SEITT staff had not observed teachers in the classroom, so the SEITT staff did not really know which teachers were changing. Hence, I decided to learn about teachers in their classrooms and in the residential periods.

researchers for use in examining teacher learning within teacher education programs. I used this as a guide as I developed my own set of questions.

Table 2.1 Selection of Teachers

NUMBER OF RESOURCE TEACHERS	DATA
48 Resource teachers	Questionnaire
7 Resource teachers from two regions* *1 not teaching at A-level	Questionnaire; classroom observations; interviews
3 Biology resource teachers	Questionnaire; classroom observations; interviews; observations of working in two residential periods; carrying out workshops in the regions

I decided to use two means for selecting teachers for the in-depth portion of my research. First, I decided on two regions that were within driving distance of where I lived. One of the regions was urban and the other was rural. Second, I turned to the survey results to select teachers to focus on. At this point, one of the problems of being far from an advisor arose. I needed to discuss selection criteria with someone. This point in the research was critical, as I was choosing the individual cases that I would be following for the rest of my research. I asked myself the following questions, "How should I use the questionnaire to select teachers? Which questions are more salient? How do I avoid questions that might show a Western bias?"

I tackled this problem by contacting two Zimbabwean colleagues who had earned Ph.D.s in Education at MSU and who were back in Zimbabwe teaching. They were Dr. Albert Natsa and Dr. Josephine Zesaguli. Talks with these two colleagues led me to two questions on the questionnaire that provided distinctions between respondents in terms of thinking about teaching and learning.

The first question asked about types of teachers who would "most likely" be successful in helping students learn. For this question, there were four brief descriptions of how teachers conceptualize teaching: facilitator, guide, group organizer, and transmitter of knowledge (See questionnaire in appendices.) Most teachers chose facilitative teaching as most effective. However, one teacher chose "transmitter". My colleagues and I felt that including the teacher answering transmitter would add a different perspective. We also thought that some of the teachers might, in fact, be giving the "facilitator" as the answer because they thought it was the answer I wanted. This is a common problem of surveys, and I hoped that the follow up interviews and observations would shed light on this idea.

The second question I used from the questionnaire to finalize my selection asked the teachers to prioritize a list of factors from 1-6 that might be sources of students' success. These included student's home background, student's intellectual ability, student's enthusiasm or perseverance, teacher's attention to the unique interests and abilities of students, teacher's use of effective methods of teaching, and teacher's enthusiasm or perseverance. My Zimbabwe colleagues and I thought that this question addressed many beliefs that teachers hold concerning learning and teaching, one of the important areas in my research. Do the teachers think that success is grounded more within the students or outside the students?

The teachers' responses split between those who thought "student intellectual ability" was the source and those who thought "teacher's use of

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effective methods of teaching" was the main source of student success.

Teachers from each of these response categories were selected.

In selecting the teachers to focus on, I worked closely with Dr. Zesaguli, who had written her dissertation on the precursor of the SEITT project, the Zimbabwe Science Teacher Training Program (ZIMSTT). We decided to start with seven teachers in order to get a diverse group in terms of their views on teaching/learning. We both thought that seven teachers might be too many; however, from experience in doing research in Zimbabwe, my colleague indicated that unforeseen circumstances might force one or two teachers to stop participating due to school responsibilities, transfers, or other events. I gathered observation and interview data on these seven teachers.

As I will elaborate on in the Data Analysis section, I returned to the U.S. with interview and observation data from all these teachers. However, I had limited data on some of the teachers' learning in the third and fourth residential periods at the University of Zimbabwe. During these residential periods, most of the studying was accomplished in subject matter groups. Since one aspect of this study intended to examine how these teachers interacted with other resource teachers and with other teachers, I decided to focus on one subject matter group. I selected the biology group because of my own background in biology; I had earned a B.Sc. in Zoology. In the residential periods and in the teachers' own classes I would be better able to understand the concepts being taught and the learners' problems with the biological concepts. In the biology subject matter group were three teachers from the two regions. These three teachers and their

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beliefs, prior experiences, teacher knowledge, and engagement with the project are the focus of this dissertation.

Resource Teachers as Learners: Qualitative

After surveying the teachers, the research design moved from the quantitative to the qualitative in Miles and Huberman's (1994) design. Here I intended to look deeper into these teachers' beliefs on teaching/learning, teaching practice, and their interaction with other teachers and teachers at workshops.

I wanted to understand the participants from both what they said and what I observed. Thus, the data came from focused interviews, informal interviews, observations in classrooms, observations of the participants learning to become resource teachers and their actual facilitating in workshops, and documents.

Probing learning and views on learning: Interviews

I conducted interviews with the teachers and with other involved parties. The interviews with the teachers were open-ended. For each interview, which lasted between one and two hours, I had an interview protocol that listed questions. At the beginning of the interviews, I gave a copy of these questions to the teachers so that they would have a feel for the types of questions I would be asking. I followed the list in order, but encouraged the teachers to elaborate on their ideas. These interviews were audio taped, transcribed, and briefly summarized.

There were four planned interviews with the teachers with each interview having a particular focus (see Appendix D). The first interview examined their

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responses to items on the survey. After examining the questionnaire responses of each teacher, I asked questions connected to each teacher's responses and probed deeper. For example, with each teacher I probed his/her meaning of student intellectual ability. Included in the questionnaire were several questions concerning the examination and I asked the teachers to explain their answers in more depth.

The second interview focused on my observations of their classroom teaching and questions around teaching and learning. I drew on my fieldnotes and asked the teachers specific questions about their teaching. For example, I questioned one teacher about why he marked papers as he walked around and checked the students' progress. About a lab day, I asked a teacher why it was so quiet and why the students worked alone.

The third interview examined the teachers' reactions to the workshops that they had organized and carried out in their regions. I started this interview by asking for their general comments and asking if they would do anything different next time. I probed these responses.

In the last interview, the teachers talked about their own past experiences as students and teachers as well as their perception of the future of SEITT. I queried the teachers about any events or people in their educational experiences that stood out. I first asked about grades one through A-level and then about experiences after A-level. I inquired about any weaknesses that they thought they might have in teaching. Additionally, I encouraged them to talk about their learning experiences in professional education.

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This autobiographical interview occurred last for a specific reason. I had talked with Mr. Tom Bourdillon, the Chairperson of the Teacher Education Department of the University of Zimbabwe, on my intention to ask the teachers' about their past experiences in education. He indicated that a researcher had done this in the past with very poor results. The teachers did not provide much detail. Thus, I thought that by waiting until after I knew the teachers, I might get richer responses to these questions. Indeed, the teachers at this interview seemed to enjoy recollecting their pasts.

In this last interview, I had two concerns. First, I was aware that the wording of interview questions could influence the answers. I wanted to make sure the wording of the questions was clear. Once again, I turned to my colleagues for help. In addition, at this point I also communicated with my dissertation advisor on e-mail and received helpful advice in the wording and selection of questions to ask the teachers about their experiences.

My second concern had to do with delving into the personal lives of teachers. I was not sure how much they would want to talk about their lives with an American who would take this away and share it with an audience overseas. However, it turned out that the teachers talked in detail about themselves and they seemed to enjoy this opportunity.

In addition to these main themes, each interview also provided an opportunity to pursue further answers to questions asked in prior interviews. For example, in the first interview I had already asked the teachers how they felt about the source of student success. However, after the initial round of

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interviews, I found that I needed to find out what these teachers actually meant by "success". Thus, a question on this was included in the second interview. In this way, a grounded theory approach was pursued with new themes emerging from the ongoing analysis and new interview questions (Glaser & Strauss, 1967).

Not all of the teachers had four interviews. This was due to scheduling problems, telephone communication problems, and other unforeseen situations, such as arriving for an interview and finding that the teacher was gone. Some days the telephones did not work, but I went to a teacher's school hoping he/she would be there. In the cases where I was not able to meet a teacher, I needed to consolidate the questions on the interview the next time we met in order to cover the main questions. Thus, the length of the interviews also varied from between one and two hours.

I also conducted interviews with several other groups of people: SEITT staff, ministry officials in the two regions as well as at the national level, and the heads of the schools where the SMCs were located. These interviews helped me understand how these stakeholders felt about the project and the participants. These interviews were also audio taped and transcribed.

Informal interviews were conducted with two groups: A-level science and mathematics teachers who attended a workshop and students in the resource teachers' classrooms. I asked the teachers how they felt the workshops, run by the SEITT participants, had helped them and how they felt about the activities. I wanted to know if they believed that the workshops were improvements over the region-run workshops and, if so, in what way. The interviews with the students

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provided a different perspective on the teaching in the classrooms. For example, students in the classroom of a teacher who drew on his students' knowledge felt that when they first started this class they were confused. They were not used to the teacher's style. However, the students soon realized that they were learning a great deal in the classrooms. The interview with the students provided a perspective that the teacher might not have been aware of. The interviews with these teachers and students were informal and not tape-recorded. These individuals were less familiar with me, and I did not want to make them even more uncomfortable.

Teaching practice and opportunities to learn: Observations

There were several types of observations carried out. These included observations of teachers teaching in their classrooms, observations of the teachers learning at the residential periods, and observations of the teachers conducting the workshops in the regions.

For the school observations, I did not participate in the class. I only observed. I again drew on *A Study Guide Package for Examining and Tracking Changes in Teachers' Knowledge* (Kennedy, Ball, & McDiarmid, 1993) to guide my observations. I constructed my own classroom observation guide that was unstructured. (See Appendix E.) In all cases I tried to observe the same class for three days in a row in order to gain an understanding of the continuity of the classes as well as the context of class. For two of the teachers, I was able to observe during two different weeks.

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On the first visit to each teacher's class, I first described the classroom. I started by drawing a map of the classroom and noting what was on the boards and tables. I noted the gender and ethnicity of the students. Then as I observed the class I tried to include as many quotes as possible. Also during the class, I would write comments to myself on why I thought things were happening (Bogdan & Biklen, 1992). This way I had a record of quotes and descriptions of the class as well as personal suppositions on what I thought was going on. Descriptive and interpretive notes were clearly labeled. For observer comments, I wrote "o.c." next to my suppositions. After leaving the school, I wrote a summary of what happened in the class and made notes of questions to ask the teacher.

Once I returned home, I transcribed my notes into my computer. In this way, I was able to observe and go over the notes in detail soon afterwards, so that I had two immediate opportunities to interact with the notes and think about what was happening in the class.

My observations at the residential periods and workshops followed a similar pattern. However, I did participate in these activities as I observed. For example, often I was the note taker for a group. Participation helped me to focus on one group as they worked together on activities. As I took notes, I also considered such questions as: How are the teachers interacting? How do they perceive their own role?

At the third residential period, when the teachers were preparing for the workshops, I also videotaped the biology teachers conducting rehearsal

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workshops with each other. I videotaped both of these and transcribed the audio sections for analysis. I did not videotape the workshops in the regions because I did not want to cause a distraction and possibly influence how the participants interacted. At the workshops, the participants did not know me and I wanted to be as unobtrusive as possible.

Data Analysis

Analysis was ongoing and iterative. As soon as I started reading SEITT documents and observing classes informally, I began analyzing the data. After tabulating the survey results, I analyzed the survey in order to find questions to pursue. I put the information in the form of a matrix with the seven teachers listed on one axis and the teachers' responses on the other axis.

Once I started the interviews, I used a qualitative software, Non-numerical Unstructured Data Indexing Searching and Theorizing (NUD*IST) developed by Roberts and Roberts (1994). It is a computer package designed to aid users in handling non-numerical and unstructured data in qualitative analysis. For me, NUD*IST was a tool to help categorize and analyze the data for themes that arose.

The first interviews with the seven teachers probed into their responses to the survey. As I read their responses, I noticed that some key issues arose among the teachers. I identified these as keywords. Thus, as I started inputting fieldnotes into the computer I had to make sure the keywords were there as part of the quotes or in the fieldnotes somewhere else. If the keywords were not in

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quotes, I made observer comments within that paragraph. This was important because an important function of NUD*IST is searching by keywords.

Then I carried out searches of the documents using these keywords. NUD*IST produced all paragraphs containing the keyword and put them in one new file. This file contained all instances with the keyword along with the name of the original file. For example, a search of documents for "exam/examination" gave me all the paragraphs that contained either word from all the interviews and observations I had put into NUD*IST. Thus, I had a sheet of all participants' utterances of exam or examination and could compare and contrast what the teachers said about the examinations. Then I put key quotes or summaries from each teacher and put this information in a matrix so that I could easily compare and contrast the teachers.

I analyzed this data and made a shorter more concise matrix from which to consider key patterns or important categories. I talked with Dr. Zesaguli about my categories to see if I was missing important points or basing the categories on a western perspective. The analysis of the survey produced issues that seemed important to the teachers. These included examinations, mistakes/errors, student-centered, student intellect, spoonfeeding, and sharing. These were some of the keywords that then guided the analysis. This list of keywords changed as more data were collected and analyzed and new issues arose. This led to new interview questions to ask.

As the end of the year approached, I felt that I needed to check the validity of my interpretation of the data. Since this research drew on constructivist ideas,

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it was important for me to hear the teachers' perspectives on my own understanding of their teaching and learning. Thus, after the last interview, I wrote data displays (Dembele, 1995) or interim case summaries (Miles & Huberman, 1994, p.79) that I sent to the seven teachers. As I did not write these up until after the last residential period, there was no time to visit all of the teachers to hear oral comments. Instead, I mailed or delivered two copies of each case sketch to the teachers. They kept one and marked responses to the other and mailed it back. All seven teachers returned the interim case summaries. This method allowed the teachers' voices to be heard as they could respond to my interpretation of the data and present their own views. Indeed, in the case studies that follow, I used some of these comments to elaborate the teachers' points.

In the U.S., data analysis continued. I had an added purpose. I needed to help my advisor understand my research. For me, this was extremely helpful in forcing me to think deeply and be concise in my explanations and justifications. For example, I offered to give my advisor the 5-10 page data drafts of each teacher, but he suggested a one-page summary for each teacher that highlighted the distinctiveness of each and the similarities they shared. In this way, I was encouraged to think about what was most important and to think about "so what" questions. At this time, I began a shift from a data collecting perspective to an analytical one, a move that was necessary to proceed in understanding the importance of the data.

The analysis of the data in search for the "so what" question did not proceed smoothly. After analyzing the data, I initially categorized the seven teachers as changing or not changing in their teaching and felt that their prior experience in schools determined in which category each was placed. However, as I reflected on this either-or grouping, I returned to the interview and observation data for more in-depth analysis. As I closely examined each case separately, I found that the story was more complex. The story included both teaching in the classroom and working with colleagues. My shift from a teacher change perspective to a teacher learning perspective also made me aware that I was now examining the teachers and their thinking rather than how they were influenced by the project. This appears a subtle change, but it was quite a leap for me. I was now thinking of the teacher and what he/she brought to and made of a project rather than how he/she fit with the project's goals. This shift in perspective also meant that I needed to look closely at the residential periods and how the teachers participated.

For four of the teachers, who were not biologists, I did not have substantial data on their interactions in the residential periods and the workshops. At this time, I decided to focus on the three biology teachers. Thus, in moving to look closely at the biology teachers and their thinking, I was also changing my lens from that of teacher change to teacher learning.

Hence, I went through several levels of analysis. Initially, I had coded according to keywords and analyzed the data for seven teachers. I compared and contrasted the teachers and wrote up a draft based on a teacher change

framework. But I came to realize that it was not teacher change but teacher learning that was a more powerful framework from which to examine these teachers. It was at this point that I returned to the data one more time with a view for understanding what the three biology teachers learned and why.

In this way, the interviews, observations and survey remained linked with each other. The survey highlighted potential areas to pursue. The first interview helped clarify the teachers' answers to the survey questions. The observations and following interviews helped illuminate the teachers' conceptions of teaching and learning and how this is manifested in the classroom, the residential periods, and at the workshops.

Limitations of the Research

The results of this study can not be generalized to all teachers in the program or even to all the biology teachers. Rather, this study suggests issues that need to be considered to promote teacher learning over the professional lifespan.

In terms of research, this study also was limited by the area of Zimbabwe that was studied. Due to travel considerations within the country, I had to choose teachers who were within driving distance of where I lived.

Additionally, my shift in perspective from teacher change to teacher learning meant that I did not ask some important questions. I also had less observational data in the classroom than I would have preferred. However, by using several sources of data, such as observations in different contexts,

interviews, and document analysis, I was able to compare observations with what each teacher said and what other literature says about teaching and learning.

Conclusion

In my research, I started with exploratory activities to learn about the project and teachers. Then I used a questionnaire to provide a broad understanding of the way the whole group of teachers talked about ideas surrounding teaching and learning. This was followed by qualitative methods that helped to probe deeper into a sub-sample of teachers to better understand their thinking and actions. Indeed, I could have chosen to only give a questionnaire or only do interviews or only do observations. Each would have provided some information. By linking the types of research, I was able to delve deeper into the questionnaire responses and use the survey as a springboard to learn about teachers' thinking and behavior in the classroom concerning the innovations they were learning about and their application in the workshops. This design led to a better understanding of how these teachers think about their own teaching and how innovations might or might not be implemented.

CHAPTER 3 THE PROJECT, THE PARTICIPANTS AND RESIDENTIAL PERIOD THREE

This study aims to understand how three teachers, enrolled in a University of Zimbabwe diploma project, responded to the project in their teaching and in the way they worked with other teachers. In order to understand these responses, we need to know about the project. Who organized it? Who taught it? What were its aims and expected outcomes? Who were the participants? What were the participants learning?

This chapter introduces the project, the participants and the two-week intensive study period when the resource teachers learned to facilitate a workshop for other teachers in their regions. I begin by describing the SEITT staff, the project's aims, and its five key elements. Then I examine the group of teachers accepted into the project.⁹ Finally, I describe the content and format of the third residential period when the resource teachers learned how to organize a teacher workshop that they were to carry out in their regions.

SEITT Project

In talking about the SEITT project, the staff of the project is the best place to begin. In professional development projects, the content and form of a project intersect with its participants through the project staff. What the participants

⁹ This information is drawn from SEITT documents, interviews, and surveys given to the participants.

encounter in a project is the staff's interpretation of the project. Thus, the staff, who present the curriculum to the participants, influence the opportunities.

SEITT Staff

The SEITT project is part of the Department of Science and Mathematics Education (DSME) at the University of Zimbabwe. In addition to the SEITT project, the DSME is involved in pre-service as well as graduate level education. Every two years, new intakes for the B.Ed.(Sc.) degree start their studies in biology, physics and chemistry. Every year, the DSME normally offers an M.Ed.(Sc.) program and a Post Graduate Certificates in Education program (Engels, 1996c).

The SEITT staff included one outside expert from the Free University of Amsterdam and four DSME faculty. The Dutch expert had extensive background with science projects in southern Africa. The rest of the SEITT staff consisted of two DSME faculty full-time, and two DSME faculty with half-time responsibilities to SEITT. One of the full-time DSME faculty was the project coordinator. He had taught A-level physics in Zimbabwe for many years before going to the U.S. to earn a Masters of Arts in Teaching. The other full-time SEITT member had taught for many years at A-level before going to England where he had earned a Masters in philosophy with a focus on INSET. One of the DSME faculty affiliated part-time with SEITT earned his Ph.D. in the U.S. The other part-time SEITT faculty member had recently joined SEITT after teaching A-level for many years and earning a Masters degree in the chemistry department at the University of

Zimbabwe. Thus, the Zimbabwe SEITT staff had all taught at A-level in Zimbabwe and were familiar with the teaching and conditions of teachers.

These SEITT staff members also had opportunities for overseas training to support their work with SEITT. There were two opportunities for them to travel to Europe for in-depth study of in-service models and to prepare for the residential periods that would be held at the University of Zimbabwe. The residential periods were two-week intensive study periods for the resource teachers. From January to March 1996, three DSME staff studied in the Netherlands and the UK. From January to February 1997, SEITT faculty prepared to teach Residential Period Three through training in the Netherlands. During this stay, the SEITT staff completely planned the two-week residential period that taught the resource teachers how to carry out a workshop in their own regions. At this time, the SEITT staff located the activities to use and developed activity sheets.

The training of Zimbabwe DSME faculty as the in-service providers was part of the SEITT project's attempt at building a sustainable program. After the funding ended, SEITT would remain a part of the DSME. This was in contrast to other projects that often bring in foreign experts for short workshops (Verspoor, 1989; Fullan, 1991). Verspoor (1989), wrote about improving the quality of education in developing countries, pointing out the need to include local educators: "High outcome programs also featured training for key administrative and professional staff and a limited use of expatriate experts" (p. 83). The SEITT project followed this path in developing its program.

Historical Perspective

The SEITT project was the third phase of the Zimbabwe Science Teacher Training program (ZIMSTT). The first two phases (1985-1992) established a Bachelors degree in science education B.Ed.(Sc.) program in the DSME. In the B.Ed. program, certified O-level science and mathematics teachers upgrade their qualifications so that they can also teach at A-level (Engels, 1994).

The ZIMSTT project started in 1985 with cooperation between the Ministry of Education¹⁰, the University of Zimbabwe and the Free University of Amsterdam (Zesaguli, 1994). Zesaguli summarizes the ZIMSTT project (1994):

... the ZIMSTT project was implemented as a stop-gap measure to increase the numbers of A-Level Science and Mathematics Teachers. This was done by up-grading certified O-Level Science Teachers by giving them an intensive content course in the subject, which they would teach at A-Level respectively. The project was initially a one year full-time crash program. After an evaluation, this was extended to two years (p. 11-12).

Phase one involved starting up the project, and its operation until 1989. Phase two began in January 1989 and ended in December 1992 and at this time the project changed to a two-year program. In 1992, the project was incorporated into the DSME at the University of Education.

Thus, these two phases of ZIMSTT were intended to add to the number of teachers qualified to teach through A-level. In 1992, the Ministry of Education indicated that improving the quality of A-level science and mathematics teaching

¹⁰ The Ministry of Education in Zimbabwe in 1992 was actually called the Ministry of Education and Culture. In 1997, it was changed to the Ministry of Education, Sports, and Culture. In this paper, Ministry of Education will be used throughout to represent both ministries.

was another challenge in the Zimbabwe educational system. The Project Document of SEITT quotes the ministry (Engels, 1996b):

The quality of the delivery of the A-level science curriculum was adversely affected with the result that scientific concepts and processes are superficially covered (p. 4).

The Ministry of Education approached the DSME at the University of Zimbabwe to help improve the quality of A-level science and mathematics. The department, working with The Netherlands Organization for International Co-operation in Higher Education (NUFFIC), instituted SEITT to improve the quality of teaching at A-level. The SEITT project focused on assisting the Ministry of Education and the DSME in establishing in-service training for A-level mathematics and science teachers (Engels, 1994, p. 15).

SEITT Objectives

The project had both long-term as well as short-term objectives. One long term objective was the "...production of qualified A-level mathematics and science teachers for upper secondary (A-level) schools in Zimbabwe." The second objective for the *third* phase (September 1994-August 1998) was (Engels, 1994):

,"...to set up an in-service unit for A-level teachers in Zimbabwe in which the Faculty of Education (Department of Science and Mathematics Education), the Faculty of Science (cognate science departments) and the Ministry of Education and Culture (Standards Control Unit) participate" (p. 15-16).

This addition of an in-service unit in the DSME for these teachers was a change from the conventional Ministry-directed in-service of the past. Previously,

most in-service of A-level teachers was carried out by the Education Officers in the regions.

While the long-term goals remained stable, the short-term objectives of SEITT changed a great deal from its initial inception. The first Project Document (1994) outlined the project from September 1994 until August 1998. According to this document, SEITT aimed to establish an in-service program at the DSME in which the faculty would carry out one-shot or short-term workshops with A-level teachers. Within this 1994 Project Document was a request to carry out a decentralization study.

(iv) To investigate the feasibility of a decentralized approach. Depending on the outcome of this study, four or five regional centres of excellence, either A-level or Teacher Training Centres could be used as Resource Centres. These institutions would function as regular venues workshops. Experienced teachers and staff could function as resource personnel to carry out parts of the workshop (p. 17).

Thus, even when the original project document was being written, there was a view that SEITT needed to decentralize and draw on experienced A-level teachers. As a result of the study, SEITT coordinators selected a decentralized system approach in order to better serve the needs of the A-level teachers throughout the country and to support continuation of the project after Dutch funding finished at the end of 1998 (Engels & Ncube, 1995).

The original model of one-shot workshops run by DSME faculty had at least two potential problems from the perspective of SEITT. First, one-shot workshops run by the DSME faculty would not be sustainable. When the funding by the donor ended, there would be no way to continue the workshops.

Sustainability was connected to the second reason to change the model. The Decentralization Study (1995) said:

Sustainability is an important aspect of the design of any inset delivery system. As much as possible, schools, teachers, and communities need to be involved in the organisation of workshop programmes (p. 10).

Thus, the SEITT staff wanted more input from the regions on the structure of in-service. This document adds, "In view of the way the economy of Zimbabwe is developing, it might be necessary to develop local expertise and reduce expensive dependency from the centrally located university" (p. 10).

In this model, which moved away from the university-based model, practicing A-level teachers were to be trained to become resource teachers¹¹ who facilitate the learning of other A-level teachers. In this cascade model, these participating teachers, who learn new ways of teaching, would return to their schools and share their skills and knowledge.

In the decentralization study in 1995, the SEITT staff suggested five regional centers: Masvingo, Mutare, Gweru, Bulawayo and Harare (See Appendix A for a map of Zimbabwe). At a SEITT national workshop, national and regional ministry officials proposed one center in each of nine regions. The ministry officials gave two reasons: 1) If there are only 5 centers, then some resource teachers will have to travel outside of their regions to the centers. This will involve time and transportation costs. 2) If there are only 5 centers, then

¹¹ The resource teachers, at the time of this study, were part-time students at the University of Zimbabwe. Throughout this article, it should be understood that they had not yet received their diplomas.

regional education offices without an SMC will not support developing an SMC outside of their region. Administrative nightmares would also arise when several regions are involved in a single center. Consequently, in the Revised Project Document (Engels, 1996c), SEITT agreed to increase the number of centers to nine, and soon, thereafter, Harare was allotted a second center due to its large number of A-level schools. Thus, ten centers were established in Zimbabwe. As a result of the decentralization study and the shift to training practicing teachers to be resource teachers, the one-shot concept of in-service changed to a decentralized model that created the possibility of more sustained professional development opportunities for teachers in the regions.

The SEITT Model

SEITT's goals for mathematics and science instruction were to improve content coverage, to promote understanding and problem solving, and to promote positive attitudes and equitable outcomes (Engels & Ncube, 1995). These were very ambitious goals. In order to reach them, SEITT had to find an "inset delivery strategy to fit the aim of improving the quality of delivering the A-level curriculum" (Engels & Ncube, 1995, p. 11). They chose the Joyce and Showers model and provided the following rationale:

Changes of attitude and improvement of classroom teaching are hard to accomplish and therefore inset delivery strategies have to be comprehensive. The most recognized model to achieve these goals is described by Joyce and Showers (1988). The following elements, dosed in a careful balance that has to be reconsidered at every new workshop programme, are part of the structure: *theory, demonstration, practice and feed back* (p. 11).

SEITT put much emphasis on this model. In fact, in Residential Period Two in August 1996, the resource teachers were introduced to the basic components of the model which consist of: presentation of theory on a new strategy, demonstration of that strategy, practice using this strategy in a setting among peers, feedback on how the practice could be improved, and finally coaching from peers or specialists in the classroom (Joyce & Showers, 1988). SEITT's model was abbreviated and did not include the coaching.

This model has both its critics and its proponents (Hargreaves & Dawe, 1990; Sprinthall, Reiman, & Thies-Sprinthall, 1996; Tillema & Imants, 1995). Criticism suggests that the model is too technical and promotes a view that one strategy works in all contexts (Hargreaves & Dawe, 1990; Sprinthall et al., 1996). However, other researchers suggest that this model can help teachers learn new strategies as a basis to build on and begin considering context and student learning (Joyce & Showers, 1988; Loucks-Horsley et al., 1998). From this perspective, teachers can learn new strategies initially, and later, in subject collaboratives or in schools, the teacher can inquire into how to use these strategies with probing questions, problem solving and other ways of examining students' knowledge.

Some research in developing countries also argues that priority should be on improving conventional teaching approaches instead of promoting more inquiry-oriented approaches (de Feiter, Vonk, & Akker, 1995). This view assumes that inquiry is not the main aim of many teachers and that they first need to learn and use strategies before they begin to examine their own beliefs. SEITT

conceived of the Joyce and Showers model in the second sense, as a means of beginning to change practice that will lead to changed beliefs about teaching and learning.

SEITT determined that the abbreviated Joyce and Showers model of delivery required that the INSET facilitators be near the A-level schools. Drawing on this and other research, SEITT developed an approach that included five key elements (Engels, 1996b, p. 23-24):

Teachers' Centers

Training of resource teachers

Networking of teachers

Integrated evaluation

Curriculum materials development

Not all elements of the SEITT project were directly connected to my specific research questions. In my work, the elements of teachers' centers, training of teachers serving in the new role of resource teachers, and integrated evaluation were most pertinent. Hence, in the following discussion, I concentrate on these elements and only briefly introduce the other components of this model.

1. Teachers' Centers

SEITT has helped set up ten Science and Maths Centres (SMCs), one in each region and two in Harare, the capital. These SMCs are the sites where the resource teachers conduct workshops, help form study groups, work with teachers one-on-one, and store material resources.

SEITT staff, in discussions with regional ministry officials, decided to establish SMCs at existing schools rather than at teachers training colleges. The

main reason for this was because the teachers training colleges were under the governance of the Ministry of Higher Education while education and schools through A-level were under the Ministry of Education. SEITT staff did not want to have to work with two different ministries.

SEITT staff asked the ministries in the regions to decide at which schools SMCs would be established. At a national meeting with national and regional education administrators, the SEITT staff discussed the need to have the regions select SMCs (SEITT, 1996). SEITT wanted the regions to choose their own SMCs so that the regional directors would feel ownership for the SMC and support the centers' activities. SEITT, however, did establish criteria for deciding the location of these SMCs. These included being centrally located, being well equipped, and having a supportive head of school. In late 1996 and early 1997, each region selected the site of its SMC. SEITT staff traveled to the regions to meet the resource teachers at the SMCs and to talk to the head of the school in order to clarify the purposes of the centers.

Between January and August of 1997, the teachers carried out two one-day workshops at the SMCs. The first workshop was an organizational one in which the resource teachers explained the purposes of SEITT and acquired feedback from teachers concerning what materials would be needed and possible hours of operation of the SMCs. The second workshop was a subject matter based, hands-on, one-day workshop. These became the focus for one of my observations and are discussed later in this chapter.

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2. Training of resource teachers

The resource teachers attended a two year part-time training program from March 1996 until December 1997 at the University of Zimbabwe. In March and August of each year, the resource teachers attended two-week intensive residential periods. They also took examinations in November of each year. The resource teachers worked towards the Diploma in Science Education (Inservice Educational Training), known as the DipSciEd (INSET) degree, a formal University of Zimbabwe program. This diploma was created for the SEITT project.

The content of the SEITT residential periods was organized around six courses. These were (April 13, 1997 letter to SEITT staff from external coordinator):

- 1. RESEARCH METHODOLOGIES:** To develop skills that will enable resource teachers to appreciate the needs and value of research and to carry out some research in a limited setting
 - 2. PHILOSOPHICAL AND HISTORICAL FOUNDATIONS OF INSET:** To understand the historical context of the education system in Zimbabwe, to gain an understanding of effective teaching, and to get a better understanding of the process of change and the process of professional development of teachers
 - 3. PSYCHOLOGICAL AND SOCIOLOGICAL FOUNDATIONS OF INSET:** To promote a collaborative working environment and to co-manage the SMCs
 - 4. CURRICULUM DESIGN, IMPLEMENTATION AND EVALUATION IN SCIENCE INSET:** To increase resource teachers' understanding of principles and models of inset curriculum design, of strategies for the implementation of a science/mathematics curriculum
 - 5. INSTRUCTIONAL DESIGN IN SCIENCE INSET:** To encourage resource teachers to consider and use a variety of teaching approaches, to help resource teachers' design and construct their own teaching materials.
 - 6. RESEARCH PROJECT:** To provide the participants an opportunity to practice research skills. Project title, "A reflective analysis of the establishment of the subject teacher group in the Educational Region". [All the resource teachers wrote on this topic.]
- EXAMINATIONS:** [End of year examinations are required by University policy.] Since this PGDipSciEd is an official element of the University of Zimbabwe, end

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of the year examinations in both years were carried out and, as per university policy, marked by outside institutions.

These elements of the project were addressed in four different residential periods over the two years. Ndeya-Ndereya (1996) indicates that though the format made the classes appear fragmented, the SEITT staff taught in an integrated manner. Ndeya-Ndereya writes:

All the six courses are team taught in a complementary fashion. The program is practical oriented, with the continuous (course work) assessment component of the final grade reflecting practical competencies as judged through demonstration (p. 263).

At the first residential period, SEITT staff defined its image of effective classroom teaching in a handout to the resource teachers. This material came from a book that all the resource teachers received, *Towards More Effective Science Teacher Development in Southern Africa*. This book was written by Leo De Feiter, Hans Vonk, and Jan van den Akker, faculty members at the Free University of Amsterdam, the same institution from which the SEITT external advisor was associated. In discussing the quality of classroom teaching, the book identified two aims (de Feiter et al., 1995, p. 41-42):

- A first aim for improvement, which may be referred to as "output-oriented", concerns increasing the effectiveness of science instructions in terms of pupil achievement within the current examination system, (higher grades, passes by more students, transition of more students to higher educational levels).

However, it should be noted that the nature and quality of currently applied exams are often in discussion (or even target of change efforts).

- A second improvement aim, which is more oriented at the classroom process itself, concerns the intention to make science instruction more meaningful for the learners (often labeled as more "student-centred"). This aspired shift can be characterized by elements like:

- more learning for understanding (less rote learning);
- more varied, interactive and activity-based learning patterns (less passive note-taking);
- more relational to natural and social context and to students' every-day experiences (less transmission of "abstract theory");
- more attention to "practical" skills, "process" skills and "problem solving" skills (e.g. observing, raising questions, formulating hypotheses, designing investigations, drawing conclusions).

The outputs, quantitative measures of improvement, were factors that SEITT could not address directly. The project concentrated on the second aim, meaningfulness as determined by student-centered learning. This was where SEITT anticipated having an impact on the quality of teaching. They hoped the teachers would use more interactive activities, draw on students' experiences and promote more cognitive skills in the classroom.

Theory on student-centered learning also came from the de Feiter text, which quoted a U.S. Department of Education book when talking about constructivism. Following is the quote from its original source (Anderson et al., 1994):

Learning requires active involvement of the student in constructing meaning. Rather than just receiving more information, the learner must negotiate meaning with his/her learning community, make connections with past understandings--modifying these prior conceptions if they are not accurate--and build understandings that are part of that person's personal conceptual framework. These new understandings occur in a learning community or context; attending to context is an important consideration in fostering learning in science and mathematics (p. 2).

Thus, SEITT documents and readings in the residential periods promoted student-centered learning that drew on students' active involvement in the

construction of meaning. This theoretical perspective on student learning came from Dutch and American sources. The SEITT faculty included this active learning and related theory in the residential periods.

Table 3.1 depicts the schedule for the residential periods. The first two periods introduced the resource teachers to theories of INSET. The third and fourth periods prepared them to carry out the work of resource teachers in the SMCs.

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Table 3.1 Outline of Residential Periods and General Content

Residential Periods

Residential Period 1	April 22, 1996 - May 3, 1996
Research Methodologies	
Philosophical and Historical Foundations of INSET	
Term Time 1 Assignment: A Context Analysis of the Educational Support System for Science and Maths teachers in their regions	
Residential Period 2	August 19, 1996 - August 31, 1996
Philosophical and Historical Foundations of INSET	
Psychological and Sociological Foundations of INSET	
Term Time 2 Assignment: To develop a plan of activities for the first year of operation of the Science and Maths Centre, which is flexible and enjoys ownership by the teachers in the region.	
End of 1st year Examination:	November 1996
Residential Period 3	April 21, 1997 - May 2, 1997
Curriculum Design, Implementation and Evaluation in Science INSET	
Preparation of the workshop: subject matter & facilitating	
Term Time 3 Assignment: Carry out a workshop in the regions and write a reflective analysis on the outcome	
Residential Period 4	August 18, 1997 - August 30, 1997
Instructional design in Science INSET	
Term time 3 Assignment: Research Project, "A Reflective Analysis of the Process of Establishing a Teacher Support System in [subject group] in [Region]"	
Final Examination:	November 1997

The SEITT project's curriculum hinged on the interplay of intensive residential study periods and intervening work in each resource teacher's region. During these intervening periods, called term times, the resource teachers continued their regular teaching and carried out action research projects related to determining in-service needs and experimenting with providing new kinds of

in-service training to their colleagues in the regions. SEITT staff tried to visit each region once during these intervening periods to check on assignment progress. The residential periods provided the resource teachers with exposure to new ideas on teaching and learning, time to discuss the new ideas among themselves, opportunities to try out new teaching strategies and time to prepare for organizing a workshop in the regions.

After each residential period, there was at least one term time assignment. These assignments were in the form of action research projects. Most were group-oriented projects that resource teachers in one region worked together to complete. For Term Time One, the resource teachers in each region interviewed administrators and sent a survey to all A-level science and mathematics teachers in their regions to elicit views on teachers' needs and on areas of the syllabus that needed support. The resource teachers constructed this interview protocol and survey during the residential period. In Term Time Two, the resource teachers met the A-level teachers in their regions to talk about the survey and work on goals for the SMCs. They also helped form the management committees at the SMCs. These management committees were in charge of running the SMCs, organizing the workshops, managing funds, etc. The management committees often consisted of the resource teachers, Education Officers in the regions, the head of the school where the SMC is based, and a parent representative of the School Development Council or the School Development Association.

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In Term Time Three, the resource teachers carried out an in-service workshop in the regions. In Term Time Four, each resource teacher wrote a final research report that was a reflective analysis of the process of establishing a teacher support system in his/her subject area and region. This was an individual assignment.

These assignments encouraged the resource teachers to interact with other teachers and with administrators in their regions while organizing the SMCs and the workshops. These assignments were oriented towards the professional development of these resource teachers and aimed to help them learn about and begin to implement some of their responsibilities as resource teachers at the SMCs.

3. Integrated evaluation

The evaluation of the project was ongoing, with changes in the project occurring as research highlighted new needs. The adjusted version of the Project Document (Engels, 1996b) states:

An integrated evaluation programme will be mounted as an integrated part of the programme. Teachers and staff from the UZ will work together to gear activities to perceived teacher needs and assess the effect of the activities (p. 24).

This integrated evaluation included research by SEITT staff as well as within the project by the resource teachers. SEITT staff developed both intake and out-take surveys. The resource teachers took these at the first and the last residential periods. The surveys asked questions about the resource teachers' needs, their current teaching practices and what they hoped to learn.

Unfortunately, as sometimes occurs in projects (Siraj-Blatchford, Odada, & Omagor, 1997), the SEITT staff had not had time to analyze this data during the period of my research.

SEITT staff, however, did carry out research and presented their findings at international conferences. At the Southern African Association for Research in Mathematics and Science Education in Johannesburg, South Africa in January 1997, several SEITT staff gave presentations on their research. The presentation on "Using Authentic Research Experiences to Develop Effective In-Service Training Resource Teacher Facilitators for Science and Mathematics Teachers in the Zimbabwean Secondary School System" discussed how the project attempted to connect theory with practice. For example, it discussed how the resource teachers interviewed ministry officials to learn about their views of A-level science and mathematics and the new SMC. They explained how this assignment was linked to the SMCs in which the teachers would be working.

The resource teachers themselves carried out research as part of their assignments. For one assignment, they interviewed education administrators and surveyed other A-level teachers. Then they analyzed these data. They also analyzed evaluation forms that the participants in the workshops filled out.

I was also a part of the evaluation of the project. SEITT staff viewed my role in SEITT as a consultant, who happened to be a Ph.D. student. SEITT staff appreciated my input as a researcher who examined the project with non-SEITT lenses and provided ongoing feedback. One important aspect of my research was the feedback I contributed on the resource teachers in the classroom. SEITT

staff were unable to visit the resource teachers in their classrooms and I provided them with that missing link.

Since I had an office in the same building as SEITT, I talked to SEITT faculty often about my research. After completing my data gathering and before leaving Zimbabwe, I gave two presentations: one at a DSME faculty meeting and another at a Faculty of Education Seminar.

As I was doing my research, I was acutely aware of my two roles: consultant and Ph.D. student. While I wanted to help the SEITT staff understand problems that might be arising in the project, I had to be careful not to identify individual resource teachers. Hence, in my discussions with the SEITT staff I always spoke in generalizations, so as not to identify individual teachers. Nonetheless, I was engaged in a balancing act between helping SEITT, maintaining participant confidentiality, and doing my own research.

The remaining elements of the SEITT project were part of the systemic approach of the project; however, they were less important to my research. Thus, I briefly introduce each.

4. Networking of teachers

The networking aspect of the project included both forming study groups and communicating with other teachers over e-mail. SEITT was promoting a model in which, after the resource teachers graduate from the SEITT project, they would assist teachers to form groups to work on teaching strategies or on the production of teaching material. Since the teachers had not finished their

diplomas when I was doing my research, this aspect of the resource teachers' work was not yet implemented.

5. Curriculum materials development

SEITT provided both curriculum materials and ideas on developing curriculum materials. It provided the resource teachers with the materials that were used to learn about innovations at the residential periods. These were also the materials used at the workshops with other teachers. SEITT also presented theories and a format to help teachers begin to construct their own materials and teacher guides. SEITT hoped the resource teachers would continue developing new materials with colleagues in the regional SMCs.

Resource Teachers

In this study, I focus on three resource teachers and how their beliefs and past experiences interact with the SEITT project to influence their learning. In the project, the resource teachers worked together to carry out assignments during both the residential period and the term time periods. Thus, the project involved both social and individual learning opportunities. Dewey (1938) emphasizes the importance of social interaction in educative experiences, as does Anderson (1994). Hence, it is important to know about all the resource teachers since they are intricately involved in creating the social context in which my three focal cases learned. This section briefly introduces the group of teachers who were selected to participate in the SEITT project. I discuss the selection process and demographic information on the teachers.

Selection of SEITT participants

The process of selecting the teacher to participate in the project began in 1995. Several regional workshops were held throughout Zimbabwe for all A-level science and mathematics teachers. Progress Report Number Four (Engels, 1996b) states:

28 out of 33 schools in the Harare Region participated. From the total of 92 A-level science and mathematics schools in all other regions combined, ALL schools were represented. A total of 441 A-level science and mathematics teachers participated, which makes the average school represented by 3.5 teachers (p. 8).

After these workshops, A-level teachers then applied to the University of Zimbabwe to become participants. The qualifications for admission, as indicated in the University of Zimbabwe's announcement, Regulations for the DipSciEd, were:

1. hold a first degree of this University, or another University or institution approved by this university; and
2. hold a postgraduate professional qualification, or its approved equivalent, obtained at this University or another institution acceptable to this University; and
3. have had at least two years' teaching experience in an educational institution recognized by this University.
4. for the INSET option, applicants must have had at least two year of A-level teaching experience.

In talks with DSME staff, it also became apparent that they wanted at least one biology, chemistry, physics, and mathematics teacher from each region. Since the number of A-level schools varied a great deal according to the region, the staff also had a formula to decide how many teachers to accept from each

region (Engels, 1996a). The minimum was four for several regions while Harare, the capital of Zimbabwe, had a quota of twelve.

Although the official requirement was two years of teaching, SEITT preferred teachers who had 6-10 years of experience. In an interview, one SEITT staff member indicated that teachers with 1-5 years of experience might still be at the survival stage, while teachers with more than 10 years might be looking for opportunities to move up the career ladder or they might be settling down into a routine.

The Participants¹²

In the SEITT project at the University of Zimbabwe, forty-eight practicing A-level science and mathematics teachers from throughout the country were trained during their vacation times in March and August over a two-year period. On completion of the program in December 1997, these teachers received their Post Graduate Diplomas in Science Education in In-Service Education and Training (PGDipScEd-INSET) from the University of Zimbabwe. This was a new diploma created at the University of Zimbabwe for this project.

Forty of the forty-eight resource teachers were male (83%) and 8 (17%) were female. Among these forty-eight resource teachers, the subject specialties were 12 physics, 14 biology, 12 chemistry, and 10 mathematics. The resource teachers came from all nine regions of Zimbabwe (Table 3.2). Harare and Manicaland each had eleven resource teachers. Though SEITT wanted at least

¹² The information on the participants in the SEITT project came from the survey I gave all the resource teachers at their third residential period in March 1997. The survey is included in Appendix C.

four resource teachers from a region, after the applicants were selected, several were transferred to new schools or to different positions. Thus, some regions had fewer than four resource teachers.

Table 3.2 Resource Teachers Regional Distribution

Region	Number of resource teachers
Harare (2 centers)	11
Mashonaland East	4
Mashonaland Central	3
Mashonaland West	2
Manicaland	11
Matebeleland North	7
Matebeleland South	2
Masvingo	4
Midlands	4
TOTAL	48

Types of schools

The distribution of the types of schools where the resource teachers were teaching at the time of the survey is indicated in Table 3.3. Church schools¹³ (38%) and government schools (31%) were by far the most numerous. School type was not included in the selection criteria. Table 3.3 also indicates that several resource teachers were teaching in teacher training colleges or working at the ministry office. They received these new positions after formally joining the project.

¹³ Though I realize that there are different types of church schools, with some having more resources than others, I decided to keep them together in one category. The type of church school was not a central factor in my research. Indeed, I am following what other researchers of education in Zimbabwe have done (see Natsa, 1994 and Zesaguli, 1994).

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Table 3.3 Authority of Resource Teachers' Schools

AUTHORITY	NUMBER	PERCENTAGE
Government	15	31
Independent	5	10
Church	18	38
District	1	2
Ministry position	1	2
Teacher Colleges	8	17
TOTAL	48	100

Resource teachers' academic and professional qualifications

Table 3.4 presents the academic qualifications of the resource teachers.

As indicated earlier, there are three main credentials for becoming an A-level science or mathematics teacher: B.Ed., licentiate, and B.Sc./Post Graduate Certificates in Education (PGCE). All three variations of preparation were represented, but as Table 3.4 indicates, the licentiates, who studied in Cuba, and those with B.Sc./PGCE, comprised 75% of the resource teachers. The B.Ed. teachers comprised 25% of the resource teachers.

Table 3.4 Resource Teachers' Academic and Professional Qualifications

Qualifications	Number (%)
B.Ed.	12 (25.0%)
Licentiate	18 (37.5%)
B.Sc./PGCE	18 (37.5%)
TOTAL	48 (100%)

Table 3.4 does hide one important fact, though. The table does not tell us where the B.Sc. degrees were earned. A follow-up survey specifically asked where the B.Sc. was obtained. Table 3.5 shows that out of 18 B.Sc. holders, 10 received the B.Sc. outside of Zimbabwe.

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Table 3.5 Overseas B.Sc. Degrees

OVERSEAS DEGREES	NUMBER (%)
B.Sc. UK	3 (30%)
B.Sc./B.Ed. in Africa besides Zimbabwe	5 (50%)
B.Sc. US	1 (10%)
B.Sc. Australia	1 (10%)
TOTAL	10 (100%)

Thus, 10 out of 48 resource teachers earned their B.Sc. degrees overseas. If the licentiates are included in overseas degrees, then 28 out of 48 resource teachers studied overseas. This fact was rather startling, as the SEITT staff had expected that most of the resource teachers were educated in Zimbabwe. However, there were no statistical data on where teachers in Zimbabwe earn their degrees, so this point would not have emerged in the selection process or in my search of documents. This also makes it difficult to determine how representative the resource teachers are compared to A-level teachers throughout Zimbabwe.

These resource teachers have a variety of educational backgrounds and teach at different types of schools. They entered the SEITT project in the spring of 1996 and graduated from the project in the fall of 1997. The SEITT project, as indicated, had many aims for these resource teachers. One important role is as a workshop facilitator with other science teachers in their own regions at the new SMCs. The third residential period was almost entirely centered on preparing the resource teachers for this new role.

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Residential Period 3 and Preparing for Biology Workshops

During the third residential period, the resource teachers studied how to organize workshops in their regions. Of the four residential periods, this one concentrated the most on helping the resource teachers acquire specific strategies to use in the classroom with students and in workshops with other A-level teachers. Since one aspect of my research is to learn how the resource teachers' own prior experiences, beliefs and teacher knowledge influence their actions working with other teachers, Residential Period Three provided a context to examine what they learned and how they learned it.

In Residential Period Three, the resource teachers spent a large amount of time working in their subject groups to develop a complete workshop. Rather than try to visit all the subject groups and gain a superficial view of interactions and learning, I decided to observe and participate with one subject group. As explained earlier, I chose to observe the biology group based on my own background in biology. In the biology group, there were fourteen resource teachers. Rumbi, Tendai and Batsirai--the three resource teachers that this research examines--were among this group.

The Preparation of the Biology Groups

Overview of the residential period

The third residential period occurred over the two weeks from April 21 to May 2, 1997. What were the resource teachers presented at this residential period? Table 3.6 presents the schedule of learning events during the residential period. The main aim of Residential Period Three was to prepare the resource

teachers to facilitate a science/mathematics related workshop for A-level science and mathematics teachers in their own regions. The topics for this residential period and the workshops were actually derived from the surveys that the resource teachers had given to regional A-level science and mathematics teachers during the first term time assignment.

Table 3.6 Biology Group's Schedule

DAY	MORNING	AFTERNOON
Monday April 21	Registration and evaluation of term time 3 Identification of problem concepts through concept mapping (all subject groups)	Feedback and information
Tuesday April 22	University of Zimbabwe faculty talk on Ecology	Experiment outside identifying types of grasses near a stream. Case study by SEITT staff on Quelea birds and damage to environment. Biotechnology survey
Wednesday April 23	Hands-on activity using paper models of DNA/RNA University of Zimbabwe faculty talk on biotechnology Case study of biotechnology on Ice Bacteria	Lecture at Science Building on recombination of genes and a demonstration
Thursday April 24	Instructional design and learning materials (all subject groups) Divide into two groups: Ecology and Biotechnology Preparing a lesson plan with learner centered activity	Continue preparing lesson plan
Friday April 25	Assessment and practicals (all subject groups) Continue preparing for lesson plan presentation	Ecology group and Biotechnology groups teach each other using the lesson plans
Monday April 28	Discuss workshops in the regional groups Workshop preparation in the two biology groups	Workshop preparation
Tuesday April 29	Plenary meeting on making a facilitator's guide for the regions Ministry of Education spokesman	Workshop preparation
Wednesday April 30	Discuss peer observation worksheet Ecology group carry out the rehearsal workshop with other group the participants	Ecology group revise workshop schedule and Genetic Engineering preparing for workshop
Thursday May 1	Genetic Engineering group present rehearsal workshop	Trip to Lake Chivero for social party

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DAY	MORNING	AFTERNOON
Friday May 2	Review workshop materials Subject matter groups hand-in sheets Regional meeting Conclusion	

The content of the residential period included specific subject matter knowledge, strategies for teaching, activities, and opportunities to organize these together into workshops using the Joyce and Showers model.

The Joyce and Showers model

The Joyce and Showers model had been introduced in the second residential period. The teachers had read articles by Joyce and Showers and examined the model's points, including theory, demonstration, practice, feedback and coaching. Dr. Vonk, an expert from The Netherlands, also had talked about peer coaching. In subject groups at the second residential period, the teachers had prepared a mock workshop using the Joyce and Showers model. The biology group's topic was Sampling Methods in Ecological Studies. The content of this mock workshop included theoretical background, demonstration, practice/feedback and coaching sections. This workshop, however, was just an exercise and it was not implemented. During the third residential period the biology teachers organized workshops that would be actually carried out in the regions and the Joyce and Showers model remained central.

The Joyce and Showers model was used by SEITT staff to introduce strategies on several days. On the first day, one SEITT staff member introduced concept mapping using the Joyce and Showers model. This staff member

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introduced this strategy by saying, "This is a hierarchical arrangement of concepts that are related" and on an overhead indicated that it had three main uses: 1) curriculum tool 2) planning tool and 3) instructional tool. Without elaborating on these uses, the SEITT member moved to a *demonstration*. In that demonstration, the staff member handed out activity sheets and asked the resource teachers--the students in this demonstration-- to:

Write down the word "curriculum" just below the text. Write down all the words you associate with when thinking of this word. Keep the following rules in mind: 1) The written words always should have a link to "curriculum" 2) You have 7 minutes for this exercise.

With the above instructions, the resource teachers then worked on a concept mapping activity. After this demonstration, there was time for discussion on the strategy and how it might work in the classroom. The participants suggested that the activity was too long and that the instructions needed to be clearer. On the other hand, they commented that the strategy helped generate new ideas. Later in the week, the resource teachers created lesson plans for teaching biological themes. This was the *practice* aspect. This was immediately followed by an evaluation of the lesson plan, the *feedback*. Thus, during the residential period the resource teachers had the opportunity to follow the theory, demonstration, practice, and feedback components of Joyce and Showers model.

Thus, the resource teachers were aware of the Joyce and Showers model as the form to use in presenting new subject matter or strategies to learners. In this third residential period, the resource teachers learned new strategies and

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subject matter that could be used with students in the classroom as well as with teachers at teacher workshops.

As we look more closely at the activities during this residential period, a shift of focus becomes evident. Initially, the student was the target of the residential period; however, this moved towards an audience of A-level biology teachers at a workshop. This was a logical shift, as the goal of this residential period was to help these teachers move from thinking solely of teaching practice to considering work as a resource teacher. The goal was to help the resource teachers learn to carry out a workshop in their regions with other A-level biology teachers as the participants. The content of the workshop also included strategies to use in the classroom. Thus, the form and content of this residential period and the workshop were closely intertwined.

Initial Focus on the Student

First week

In Residential Period Three, many of the early activities focused on how to use strategies in classrooms. For example, on Tuesday of the first week, a University of Zimbabwe professor came to talk about ecology. He introduced ecology by asking what ecology was. He then defined it using Greek words and added that it was a, “young dynamic subject with various definitions. It is the study of relationship between/amongst organisms.” The professor also talked about the use of metaphors to help students understand concepts. He said:

Niche is the position or role that an organism plays in a habitat. You can't have two organisms in the same niche. Niche is like head of state, father in

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the house, or headmaster. If there are more than one, what happens?
(residential period 3 notes).

The following exchange then occurred:

Resource teacher 1: Metaphors like president are not good on the exam. How about examples for the exam?

University of Zimbabwe professor: If students understand concept, they should be able to give examples.

Resource teacher 2: If students give concepts on exams, it shows that they understand the concepts.

University of Zimbabwe professor: I want them to understand concepts. Assist them but don't spoonfeed them. If they can come up with their own, it shows that they know. Ecology is in section G in the syllabus. Your understanding must be broader than the syllabus. Give students more.

Resource teacher 1: Back to the introduction. The definition of ecology is to motivate at the beginning. The way you start, would it hold for our students?

University of Zimbabwe professor: You might ask, "How have actions of other people on the environment affected us? How do actions by neighbors influence us?" Don't think like biologists.

Resource teacher 3: Let students go observe. The students can suggest causes.

Resource teacher 4: The next door class is making noise.

Resource teacher 5: Someone steals from you.

University of Zimbabwe professor: How students are directly affected. Maybe some have a farm.

Resource teacher 6: Cut down trees.

University of Zimbabwe professor: How does it affect you? Motivation. Then clarify the problem: pollution, deforestation. Then look at it. Show a film, bring in something. We have resources. Newspaper headline. Mugabe in paper criticizing governments that put environment before people.

Resource teachers at this point in the residential period were thinking about how the content of SEITT could be used in their own classrooms. Metaphors were discussed in terms of how they could help students understand concepts, answer exam questions, and increase motivation. The above dialogue particularly shows how the instructor was trying to link ecology to the everyday lives of the students.

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On Tuesday afternoon, a SEITT staff member introduced a case study to use for Ecology. This case was about the Quelea bird and how to handle the problem of these birds destroying crops. While in The Netherlands preparing for this residential period, the staff had located this case study. The SEITT staff member handed out this case study packet, which included sections on syllabus links, using the unit (including time suggestions), notes for guidance, study guide on the Quelea problem, and an evaluation section that explains which answer would be best. In the case study on Quelea,¹⁴ the participants acted as senior pest control officers for the government. The officers' job was to decide whom to help and why among three requests to exterminate Quelea. The actual question was "You may only respond to one of these requests because time and resources are limited. Which one do you choose? When you have made your choice prepare a report which justifies the decision and explains your proposed course of action."

One request came from a subsistence farmer, one from a local field officer in the Crop Protection Department who had located Quelea in the area of a Government Development Scheme, and the third from a member of the Bird Control Unit of the government. Groups worked on the question and presented their answers.

On Wednesday, the resource teachers learned how to use paper models of DNA-RNA to demonstrate the structure to students. This was presented using the Joyce and Showers model. This involved constructing paper models of DNA

¹⁴ See appendix F for the actual instructions for the case study on Quelea.

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and RNA. A SEITT staff member introduced the paper model and divided the class into groups. Each group received paper models of the amino acids and bases that make up DNA and RNA. They then had to construct a DNA molecule and then an RNA molecule. After this, each group discussed and wrote down the benefits and drawbacks of this model. In this feedback session, a discussion about practicals and students in the schools arose. One resource teacher said, "Students can't do practicums, they can't interpret results, they can't do experiments, and they always go to the text. They don't have trust in their own skills." The resource teachers discussed how students may learn concepts but not how to put them to use. One resource teacher provided an example, saying that students learn temperature but do not know how it relates to agriculture.

These discussions revolved around the students and their shortcomings. They focused on how students do not have the skills in biology and confidence in themselves. It is interesting that the conversation seemed to accept these as structural barriers to the teachers' work. The resource teachers did not talk about how to help students learn to carry out experiments or how to gain confidence. This aspect of learning was not a topic during the learning of strategies. As we will see, throughout the residential period, discussions on student learning tended to be rare or superficial.

On Thursday of the first week, the resource teachers divided themselves into two groups: Ecology and Genetic Engineering. Most of Thursday they worked in these groups preparing lesson plans to use to teach the other group on

Friday. The resource teachers received an activity sheet to prepare the lesson plan (Table 3.7).

Table 3.7 Activity Sheet: Lesson Planning

Time	Student	Teacher	Equipment
	Activity	Activity	Needed

This activity sheet encouraged the teachers to think about what both the students and teacher were doing. It suggested that both should be involved. On Friday, the Genetic Engineering group taught the DNA-RNA paper models to the Ecology group, and the Ecology group taught the case study on Quelea birds to the Genetic Engineering group. Hence, the resource teachers had the opportunity to try out a strategy they had seen modeled earlier in the week.

I was able to watch only the DNA-RNA class. In this class, one member of the group introduced DNA as the dogma molecule and indicated that it was central to genetics. Then members of this group handed out the paper models of the constituents of DNA and RNA and asked the other group to divide into pairs to make a DNA molecule, an RNA molecule and then recombinant DNA. As the "students" were making their models, the Genetic Engineering group members walked around to watch. After all the groups had made the molecules, the class stopped and talked about how this lesson could have been improved.

During the feedback session, one comment was that the opening of the lesson needed to be more interesting and motivating to the students. This

comment on the "class" focused on the students: making the opening interesting to attract students' attention.

One strategy fits

The resource teachers seemed to conceive of the case study and paper model as merely strategies to add to their bag of tricks. The discussion with the University of Zimbabwe faculty revolved around gaining students' interest and about finding or using attention grabbers. The discussion after the DNA-RNA presentation also talked about the shortcomings of students. Students were presented as a group who could not do experiments. When the resource teachers tried out using the strategies, they also did not talk about how individual students might react to this strategy or what the students might be thinking. Rather the questions focused on gaining the interest of all the students.

The discussions assumed that these strategies could be easily transferred to each resource teacher's classroom. The resource teachers acquired a general, technical skill that could be used in any classroom.

Shift Focus to Workshops for Teachers: Focusing on Strategies for the Workshops

The session on the lesson plan on day four (April 24th) seemed like a transition point in the program when discussion shifted from teacher to resource teacher. The lesson plan was geared towards teaching in a classroom and how to present the themes of ecology and genetic engineering. On the following Monday, the preparation for a workshop rehearsal with A-level teachers as the focus, began in earnest.

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This second week, the groups started preparing the Human Activities (formerly Ecology) and Genetic Engineering topics for presentation at a workshop in the regions. The resource teachers were given a workshop preparation sheet on Monday. It included the following aspects of workshop preparation (Table 3.8).

Table 3.8 Workshop Preparation Activity Sheet

Aim		
A.		
B.		
C.		
Activities		
A.		
B.		
C.		
Outcomes		
A.		
B.		
C.		
Materials		
Programme		
Time	Activity [Methodology]	Tutor(s)

This worksheet provided the resource teachers with a structured format from which to prepare their workshop content. The worksheet was a step-by-step process. In the two groups, the resource teachers filled in this sheet. The groups had to agree upon the broad aims and outcomes and then the activities and use of time.

On Tuesday, they received a more detailed activity sheet (Table 3.9). This one again focused on time and activity, but specified what the facilitator and participants would be doing at different times.

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Table 3.9 Workshop to Prepare for Activities During the Workshop

Develop a detailed workshop plan for the workshop programme. Use the table below.			
Time	Participant's Activities	Facilitator's Activities	Equipment Needed

This second worksheet was nearly the same as the lesson plan worksheet (Table 3.7) except that "Participant" had replaced "Student" and "Facilitator" had replaced "Teacher". By using a similar worksheet, SEITT was suggesting that organizing teaching was quite similar to organizing a workshop.

This second worksheet focused the resource teachers on more specific aspects of the workshop. It focused on doing, and it claimed that doing involved activities of both facilitator and participants. This made it clear that participants would be active do-ers, not simply passive recipients. That activities were listed as plural also implied that lecturing was not the only available activity of a facilitator. SEITT urged the resource teachers to incorporate these active learning activities that had been presented at this residential period and previous ones.

These activity sheets were very helpful to guide the resource teachers towards how to organize the workshop and what to do when. On the other hand, they also limited the thinking of the resource teachers about how they might think about organizing the workshop. The resource teachers did not have to think about what was necessary to prepare the workshops. Their worksheets offered a framework that literally shaped their thinking. The activity sheets needed only to

be filled out. In a sense, by providing the formats, SEITT staff were spoonfeeding the resource teachers and focusing them on the procedural aspects of teacher learning.

The resource teachers did have one opportunity to develop their own activity sheet. On Tuesday of the second week, the biology group created an evaluation form that the participants would fill out to provide feedback. Table 3.10 illustrates this evaluation form.

Table 3.10 Rehearsal Evaluation Worksheet

EVALUATION OF WORKSHOP REHEARSAL	
Grading categories to be used for each of the aspects listed below:	
Unsatisfactory [U]	
Good [G]	
Excellent [E]	
Planning	
Workshop program:	Complete Clear Order Realistic
Workshop materials: (quality and clarity and interrelatedness of components)	Aims Activities Outcome Homework Assessment Materials
Execution	
Timing	Overall flow
Organization	Overall organization
Evaluation	
Evaluation instruments	Quality
Feedback	Quality of receiving
OVERALL GRADE= _____	

The construction of this sheet stimulated the resource teachers to discuss what was important to think about as both participants and presenters. The discussion centered on the meaning of terms. Specifically they grappled with questions such as:

- How to define the term "time management"?
- What to look at specifically? Different styles?
- What does the term "organization" mean?
- Should the participants focus on the whole workshop or focus on a few activities?
- Do the participants need to observe weak/strong points?
- How can we measure the quality of the conclusion?

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By discussing these questions, the resource teachers had the opportunity to think about the rehearsal and the workshop from the perspective of both facilitator and participant. What really counted as quality in a workshop arose as an issue.

This peer interaction around the evaluation form helped this group take into account how the participants, other A-level biology teachers, might respond. This led to one resource teacher saying, "At the workshop, teachers will realize they are guinea pigs to help SEITT evaluate resource teachers." Another resource teacher, responding to this statement, replied, "In the beginning we need to create an environment conducive for peers to learn. It needs to look like 'class'."

The "guinea pig" statement indicated that at least one resource teacher was concerned about the workshop being part of the resource teachers' assignment. One other resource teacher was concerned with the workshop and how it could be productive for the participants. This resource teacher thought about creating an atmosphere for learning to occur.

This exchange makes clear that there were different views on the workshop and its purpose. These views may well have influenced how the resource teachers approached the workshop and whether they attempted to go through the motions or endeavor to create a learning environment. The resource teacher who expressed concern that the participants would be guinea pigs was not one of the three resource teachers that I followed. Thus, I am not sure how that particular workshop was carried out.

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Creation and discussion of the evaluation form provided opportunities for resource teachers to exchange ideas about how to make the workshop an educative experience for the participants. They discussed the meanings of words and what the participants needed to think about. This was an authentic opportunity to consider how they, as teacher educators, needed to think about what the learners were being introduced to. This evaluation sheet was used in the rehearsals that occurred in the following two days. However, for the workshops in the regions, the SEITT faculty developed their own evaluation form. While this did help them have the same form for all subject matter groups, by not using the ones that the resource teachers had developed, the resource teachers could have felt that their own ideas were being ignored.

Rehearsals

The rehearsals were the practice under simulated conditions that Joyce and Showers advocate. They were opportunities to practice the activities and receive feedback that could be used to improve the presentation for the real workshop.

Human Activities (Ecology) rehearsal

On Wednesday, the Human Activities Group presented their workshop. This took about three hours. The general format for this was an introduction; concept map of human activities that focused the theme to the problem of using pesticides in agriculture; Quelea case study; marking examination questions; and summary of the workshop.

During the introduction, the resource teacher clarified that the participants had already examined ecologically related concepts with their students and were now investigating the influence of man on agriculture. The resource teacher said:

Good morning, we are all aware that we have covered the basic concepts of ecology. We have looked at such concepts as habitat, environment and many other concepts. In the contemporary world, scientific technology influences the environment in new ways. We use methods of agriculture that damage our environment. Many leaders of the world met in Rio de Janeiro to look at some ways nations can come together to lower the impact of man on the environment. To highlight this, let us look at some of the ideas put across by the President of Zimbabwe of the impact of man on the environment. We are going to look at this aspect. [Overhead of front page of Herald: Linking aid to "green" issues slammed] What comes into your mind? Let's see what immediately comes to your mind?

In this introduction, the resource teacher was placing the topic within the syllabus, connecting it to the local context of Zimbabwe, trying to promote an interest in this topic, and attempting to learn what the participants knew about the issue.

This was followed by another resource teacher, Batsirai, doing a concept mapping activity. I talk about this in more detail when I present Batsirai's case, so here I only briefly describe his role. He wrote HUMAN ACTIVITIES on a large paper and asked the participants what they thought of. Then he said, "Now you have produced a list. What I would like you to do is produce a group of effects. Can we get in pairs and put the activities together in a list of pairs." After about five minutes, he asked the pairs to report. Some of the answers included erosion, cutting down trees, flooding wars, hunger pollution, construction of buildings. Batsirai then said:

We are mainly interested in agriculture, so we would like to focus our attention on man in terms of what he does. We need to go to pesticides to see what these pesticides are used for and after that the effects on the environment.

Immediately, another resource teacher introduced the Quelea birds and the case study. The transition from Batsirai to the next presenter was not smooth. Batsirai jumped from a list to a specific problem to address that was not part of that list.

The next resource teacher then divided the participants into groups and asked that they read the activity sheet for the Quelea bird. She used the handout that was used in the presentation during the previous week. After fifteen minutes of group discussion, a member of each group reported to the whole group.

The case study was followed by an activity that addressed social issues. The facilitator said:

I have here a question to try to show our pupils and prepare them to answer examinations and to analyze these problems as required on the syllabus. The question you see here is in two parts. 1a discusses the conflict of interest between production and conservation. It is worth 10 marks. Then it asks to describe the alternatives to control Quelea birds and list the alternatives. This is 8 marks. The total marks are 18. Now what we want to do right now is list some of the possible conflicts right now. I think we can do that in three (video transcription).

This aspect of the rehearsal produced the greatest discussion. The participants were concerned that the mock examination, right after the Quelea case, might narrow the students' thinking to only the Quelea problem. One participant asked, "Is sorghum the only crop to consider, as in the Quelea case study, or are there other crops?"

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After this section on the examination, another resource teacher concluded the rehearsal workshop:

We would like to establish the SMC in the area of science and math education, with the aim that we are trying to improve the quality of science and math teaching by using these math and science centers. The second aim was to examine some of the methodologies to teach ecology using materials and examples. And in this respect we have been using group work as an effective method of teaching ecology and biology using the snowball method. We have learned much that can be applied in our classroom teaching. And also we have looked at conflict of production and conservation by looking at the Quelea problem and the conflicts that arise when we compare the attitudes of the farmers and also those of the conservationists in preserving the environment for generations. And there may be other areas of conflict which, unfortunately, we have not been able to touch on in this workshop. However, we have got handouts to accompany and a short list of textbooks to teach this subject.

This provided a thorough summary of the whole workshop. It linked the workshop to the SMCs and to learning new strategies. Finally, a feedback section on the whole workshop occurred, which represented the fourth aspect of the Joyce and Showers model. The participants talked about their reactions to the workshop. One critique by the participants was that the introduction did not provide the aims of the whole workshop. The participants wanted to have a better understanding of the purpose of the workshop at the beginning. Another comment from a participant referred to the time allocation. He suggested that the participants did not have enough time to discuss the questions in groups.

Though there were limited comments by the participants, the ones that arose suggest that improvements were needed in clarifying the aims and providing more time for participants to talk. The suggestions were procedural in that they addressed the broad issues of carrying out the workshop.

Genetic Engineering rehearsal

The next day, the Genetic Engineering group rehearsed its workshop. The opening was much more focused than the previous rehearsal. The resource teacher started with the broad aims:

to get us all together so that we can share our experiences, 2) to gain some experience in using motivating activities, 3) to gain insight into the control of genetic engineering (video transcripts, May 1, 1997).

This resource teacher then reminded the participants that they had completed a questionnaire last year and that Genetic Engineering was one of their concerns. She then introduced three activities:

In order to appreciate what we can do in the classrooms, we have a number of activities lined up for you which are all intended to help us gain an understanding of a variety of activities we can do with our students. So, following is our program. We are going to have three main activities: one being on DNA as central dogma of biology, the second on principles of genetic engineering and the techniques, and then you will have the application of genetic engineering.

This introduction provided the participants with a map of activities. Rumbi, another of the focal teachers in my study, then took charge and introduced DNA as the engine of engineering and quickly went into the activity with the paper models of DNA and RNA. After forming two groups, she gave the groups ten minutes to complete the activity. This involved constructing models of DNA and RNA; constructing paper models of recombinant DNA; and each group discussing and writing down the benefits and drawbacks of this model. Though Rumbi had designated ten minutes for this activity, it took thirty minutes.

After the discussion, Rumbi shifted to a whole group feedback session by saying:

We are all free to contribute. As you know, this center is for us all. All of us. It is our thing. So be free. Never in Zimbabwe have we teachers had our own thing! I feel great!

Rumbi then did a little dance to express her view that the workshop that they were preparing to carry out was very different from the workshops these teachers had attended in the past. Most workshops had been organized by the regional offices and involved an "expert" coming and telling the teachers about a topic the teachers often are not interested in. Rumbi knew that the workshop they were preparing to carry out was quite different. It would be run *by teachers for teachers* based on their own needs. She wanted her colleagues to know her feelings on this.

After this dance, Rumbi had each group present their model. A discussion followed on its limitations and its uses. This discussion on the limitations and the benefits of the model was also part of the initial presentation by the SEITT staff. It was meant to encourage the participants--students or teachers--to think about how this model could help the participants understand the structure of DNA and RNA. In the discussion, one limitation was that the model was not six-sided. Another participant added that the paper model clearly demonstrated the process of replication and transcription. Then one participant stated:

Since we are dealing with a model, it can not have exactly the objective reality portrayed on it. But now it is an educative aspect when the student can identify its limitations. Then we can say, "Ah, ha. He has learned something."

This participant suggested that students could learn by using the model and asking questions about its use. He realized how a discussion on the limitations of the model could help students think more about the real structure of DNA and RNA. This participant's comments were concerned with how students can learn about the real structure of DNA and RNA using this model. It was a student-focused comment.

However, most of the comments were related to technical aspects of the presentation. In evaluating this use of the DNA model, one participant suggested that time was wasted at the beginning of the activity because the participants had to separate the DNA and RNA papers. This participant suggested that the facilitator provide the students the DNA and RNA paper models in different containers. Another added that if the RNA and DNA were different colors, this might help. After these comments, the workshop moved on.

Another resource teacher gave a brief lecture on genetic engineering to provide the participants with new knowledge that many would not have. This lecture material was based on the lecture that the biology teachers had attended during the first week of the residential period.

Following this lecture, one more activity was carried out. Another resource teacher introduced an activity in which the participants had to genetically engineer some insulin using paper models. This was an activity that the group had found in a book, and this was their first time to try it. In this activity, the participants followed directions on the activity sheet to cut out a part of a gene

and attach to another DNA model to simulate the construction of insulin. More detail of this activity is included on the chapter with Tendai.

These rehearsals provided resource teachers opportunities to try a dry run of the workshop and to learn about aspects of the workshop that needed to be improved. Some of these aspects were clarifying goals, managing time, motivating participants, and exploring new ways of representing subject matter. Doing the rehearsal at the residential period also provided the resource teachers with a safe context to practice what they had learned, a part of the Joyce and Showers model. The feedback sessions, as we saw, provided quite a few ideas on how to improve the workshop. Before these resource teachers left for their homes, they handed in final drafts of their activity sheets and facilitators' guides so that SEITT could make final copies for the workshops.

The Project's Enacted Conceptual Framework

By looking at the projects' aims, model and the form and content of the third residential period, the conceptual framework of the project emerges. The Joyce and Showers model, as used by SEITT, of theory, demonstration, practice and feedback, was central for presenting activities and having the resource teachers work with them. SEITT did not include coaching from peers or specialists in the classroom, although Joyce and Showers (1988) suggest that this is extremely important for new teaching practices to become part of the repertoire of teachers. This was, in part, because of limited SEITT staffing. With the resource teachers teaching all over the country, it would have been very difficult to visit each teacher and to observe him/her in the classroom.

SEITT did focus on presenting the resource teachers with new strategies that would encourage active learning in both the classroom and workshops. Thus, as was indicated in the class that presented the aims, SEITT did promote "more varied, interactive and activity-based learning patterns." However, involving students in the learning seemed limited to participating in activities. It did not completely embrace the idea of constructivism that was presented in the second residential period:

Learning requires active involvement of the student in constructing meaning. Rather than just receiving more information, the learner must negotiate meaning with his/her learning community, make connections with past understandings--modifying these prior conceptions if they are not accurate--and build understandings that are part of that person's personal conceptual framework (Anderson et al., 1994, p. 2).

The activities that were introduced included the learner as a participant of doing, but not necessarily as making cognitive connections. In the preparation of both the lesson plan and the workshop, the focus was on creating the opportunity to interact but not on negotiating meaning. In this way, the teacher/resource teacher seemed to be viewed as a technician organizing learning opportunities, with an eye on the clock and an eye on encouraging the generation of ideas, but not necessarily on negotiating the meaning of these ideas.

Summary

The SEITT project was established to help improve the teaching and learning at A-level science and mathematics. SEITT chose a decentralized project in order to reach the teachers in their regions. The five elements of the project were the establishment of the SMCs, the training of resource teachers,

the networking of teachers, an integrated evaluation, and the development of curriculum materials. Within this structure, the project drew on a version of the Joyce and Showers model to deliver the content. It omitted the key coaching element of the Joyce and Showers model. Furthermore, the SEITT staff also seemed to think that it needed to first change the teaching practice of teachers before addressing their beliefs.

There were forty-eight participants in the SEITT project. Though SEITT tried to have at least four teachers per region, three of the nine regions had fewer than four. All of the three types of professional qualifications, B.Ed., licentiate, and B.Sc./PGCE, were represented. However, a surprising fact was that ten of the eighteen B.Sc./PGCE holders had earned their degrees outside of Zimbabwe. If the licentiates were included, that means that twenty-eight out of forty-eight resource teachers had studied abroad.

This chapter has introduced us to the SEITT project, the resource teachers, and one extended learning opportunity for the biology group. It has provided a big picture of the project and participants. In this study, I examined what and how three teachers learn in SEITT and what they make of this opportunity. Hence, I needed to know what they brought to the SEITT opportunity in terms of beliefs and prior experiences. I needed to know how they currently taught and some of their justifications for that teaching.

In the next three chapters, I draw a narrative picture of three of these resource teachers. I use a thick description (Geertz, 1973) of their teaching, their

views of learning and their views about what they think they have gained through participating in the project.

CHAPTER 4 RUMBI: A RESOURCEFUL LEARNER CAUGHT BETWEEN THE OLD AND THE NEW

I think SEITT helped me a lot because before this program I was more concerned with completing my syllabus... After I started this program, I realized that the completion of the syllabus is not the most important thing. You may complete the syllabus yet the students may gain very little. I may cover three-fourths of the syllabus yet my students may gain quite a lot (int-1, July 1997).

Sometimes there are certain factors that will force you to do something that you know is not the right way to do. For example, active learning which will involve students a lot. When you look at some of these syllabi that we have in Zimbabwe, they are too long. If you use those methods quite often, you will not be able to complete the syllabus. If you do not complete the syllabus, students will fail. If they fail, you are blamed. So sometimes, I know it is the right way, but because of these issues and factors you tend to brush aside some of the right ways of teaching (int-2, October 1997).

In these two quotes, Rumbi made conflicting remarks on how she viewed learning. In part through her experiences in SEITT, Rumbi was beginning to see that active learning could help students. On the other hand, this type of learning took time that needed to be used to finish the syllabus. If the syllabus was not completed, students would not do well on the A-level examination. Rumbi was, in a sense, in-between in how she thought about and used new strategies. She was looking for a balance between getting the information to the students quickly and letting the students share in constructing knowledge. One is based on her old way of teaching and the other on the new ideas she was introduced to while participating in SEITT. How did this shift occur and how did she come to want

this balance? To understand this, we need to know about Rumbi the learner, her learning opportunities and how she made sense of this learning. The place to start, when thinking about Rumbi as a learner, is why she decided to participate in this professional development opportunity.

Rumbi the Learner

Motivation: To Improve Teaching and Understanding of Biology

One of the reasons that Rumbi decided to participate in the project was to improve her teaching. The other reason was to improve her understanding of the biology subject matter. Rumbi said:

I always had the interest to improve myself but when you look at the programs offered at UZ, some of them don't apply. For example, they offer administration, and other disciplines, but there was nothing to specifically improve the teachers, especially graduate teachers. I discovered SEITT and thought this must be the course that will help me improve my teaching style and understanding of subject (int-1, July 29, 1997).

In addition, on the survey that I gave to all the resource teachers during the third residential period, Rumbi suggested that in the future she would like to work at a university as a lecturer. The project could provide her the necessary diploma for that career step.

When Rumbi talked about what she had expected in SEITT, the ideas were about improving her teaching in her classroom and adding to her subject matter knowledge. These were her expectations of the project, but what did she bring to her teaching? What experiences in her past shaped her current views of teaching and learning?

Strictness, Subject Matter, and Pedagogy: Learning from Experiences

After primary school, Rumbi attended a mission-run nursing school for three years. She was a nurse for several years before going to the US, where her husband was sent to study. In the US, Rumbi entered a university and earned her B.Sc. degree in biology and chemistry. She had wanted to study in the medical area, but she said that at that time, priority in the medical field was given to US citizens. After returning to Zimbabwe, she had hoped to work in the medical field again, but she would have had to train for two more years to teach nurses. Rather than train more, she went to the Ministry of Education and received a teaching position. She started teaching in 1982 and from 1984-1985 she studied part-time for her PGCE. Since 1982, she has been teaching at former group A schools, which had been for whites only before 1980.

In her past experiences, what stood out for her? As I will explain, Rumbi seemed to view her education as occurring in stages. At different points in her life, different types of learning occurred. Some of the key remembrances for Rumbi were strictness of teachers, overwhelming expectations in learning, and a division between acquiring subject matter and pedagogy.

Rumbi indicated that there were several people she remembered as a student. They were all strict. In second grade, one teacher was very strict and a disciplinarian. Rumbi says of this teacher, "He was a very strict person, very strict and he would beat well, not a little bit but wow... and he would demand high quality" (int-2, October 15, 1997). At standard six in primary school, there was

another teacher who was strict but a dedicated teacher. This teacher created time in the afternoons to help students. Rumbi said of this teacher:

That one was also very strict and he was dedicated in his teaching profession. But not beating like the other one. He was very strict and dedicated. He would even create some afternoon lessons that were outside the timetable on certain areas, which he thought we needed more help (int-2, October 15, 1997).

In nursing school, her academic tutor was also strict. This teacher was an American and Rumbi said of her, "She was very strict and very hardworking. As a result, out of that whole class, there were ten girls, only one failed. The rest came out with distinction."

In Rumbi's early stages of education, the strictness of the teachers stood out. Both in the lower grades and in the nursing school, she talked about the strictness. Except for the one teacher who beat students, this strictness was not presented in a negative tone, but as connected to "dedication" and "hard work". This strictness did not continue to be a key aspect in her college years, however.

In the U.S., Rumbi majored in Biology and Chemistry and she remembered this time as being overwhelming. Only one teacher created time after classes to help those who had problems. She said that this made him different from the other teachers who "would just rush".

However, Rumbi indicated that she was used to the American style because her teachers at nursing school were Americans. She said, "So when I went for my degree in the US, I was already sort of used to the American people, how they teach (int-2, October 15, 1997)." She added that the big problem for

international students in the US was the amount of work expected. It was overwhelming. Rumbi elaborated, "It was demanding. We were getting all these subjects and the foreign students were required to take a minimum of twelve units, not less than that. So it was very demanding. Unlike at nurses training where you only concentrated on two main subjects."

When talking about her life as a student in Zimbabwe and in the U.S., Rumbi did not think that these experiences played a major role in influencing how she taught. She said that her primary and nursing education were quite different from secondary, and that her education in the US earning her B.Sc. was too different from the situation in Zimbabwe to draw on when teaching at A-level. Rumbi said of her primary years, "That was primary and you can not take the way you were taught at primary and fit it into secondary" (int-2, October 15, 1997).

Rumbi said of her study in the US and its influence on her way of teaching:

And when I was doing my degree, for me to try to fit in the way I was taught in America into here, it doesn't. For one, it is materials. If I tried to do it, I don't have the materials to teach the way I was taught. And also, Americans, they assume too much that you should know. And here if you take a class you take it from the roots up. You don't assume.

Rumbi suggested that as a university student in the U.S., most of her teachers did not take into account what students had already learned. Though Rumbi suggested that these experiences did not influence how she taught, they did help to shape her views of what learning and teaching encompass from a

student's perspective. Her experiences in Zimbabwe in the Post Graduate Certificate in Education (PGCE) program at the University tell us more about her becoming a teacher.

After returning to Zimbabwe, Rumbi became a teacher. She was hesitant to teach at A-level because she was not sure if she could teach that level. Rumbi said:

Before I got my GradCE, I wasn't sure if I was doing the right thing. Also, at first when the headmaster requested that I teach A-level I was against it because of my lack of training. I thought it was a non-start. At first, I refused (int-2, October 15, 1997).

At that time, there were few science teachers and the ministry asked people like Rumbi--people with B.Sc. but no education background--to teach at A-level. Rumbi said of her teaching at that time, "The ministry requested me and others to teach A-level even without training, but as time went on I got used to it. I gained confidence. I progressed."

After teaching for two years in Zimbabwe, Rumbi attended a two-year part-time PGCE program¹⁵. Her first comment on this program was that there was not enough time to learn the material. She said of this, "I felt it was too much work for a limited time... when you are doing part-time you are fully employed at the school. The head master has nothing to do with your program. You have to still fulfill all the duties at the school" (int-2, October 1997).

She added though:

After I graduated from my first degree, I taught for two years before I was trained. I knew the content of my subject, my problem was how to tell these kids so that they can understand... When you have all this data and content in your head, you don't even know where to start... I think the PGCE did quite a lot. How to dish out what I had in my head (int-2, October 1997).

She talked about the PGCE program as training her and helping her to "dish out what I had in my head". This program seemed to have taught her to become a technician, one that could effectively tell the students what they need to know. She learned that the teacher transmitted knowledge.

Conceptions of Learning and Teaching: Covering the Syllabus

Rumbi's conceptions of teaching and learning revolve around her views of students at different stages in the education system and her view of the A-level examination. These two ideas are the focus of this section. Rumbi suggested that learning at A-level and learning at lower levels were different. In the survey I gave at the beginning of residential period three, I asked the teachers what type of teacher would most likely be successful in helping students learn and I presented four teachers and their styles of teaching. In the interview, Rumbi said that Tawanda, the group-oriented teacher, would be better for A-level students and Albert, the structured teacher who gives facts, would be better for lower levels:

Tawanda would give the students opportunity to exercise their reasoning ability. Also the students would be able to discover for themselves instead of just dictating to them...the beginners, when we take in form 1, there is no idea

¹⁵ University graduates with a B.Sc. but no professional education background need to take the PGCE in order to stay in teaching.

what science is all about. You have got to start it right from the ground and tell them what science is all about (int-1, July 29, 1997).

In her view, the lower level students needed more structure for learning. The teacher might even need to be strict in making sure the students learn. A-level students needed opportunities to think and discover for themselves. Through participating in SEITT she was able to provide these opportunities in her A-level classes.

This format of putting students into groups to discuss biology questions was used in two classes that I observed. This arrangement did provide students opportunities to think and discover ideas for themselves. On February 4th, her A-level biology class studied the transport system in plants. Rumbi told the students to get into groups and to consider why the transport system was important. The students quickly moved into groups of about three students and discussed why the transport system is important in plants. While the students were discussing this question, Rumbi talked to me about A-level and showed me the A-level syllabus and explained what questions she was addressing in class this day. After about twenty-five minutes, Rumbi asked one person from each group to report back the group's results. Rumbi wrote the answers on the board. After all groups had reported, Rumbi summarized the important aspects of the transport system.

In this A-level biology class, Rumbi provided her students with the opportunity to talk over ideas with classmates. Moreover, this vignette illustrates that the A-level biology syllabus is central to her teaching. Much of what Rumbi

taught in her classes was directly associated with the examination and the syllabus. Rumbi's assignments and experiments were often from old A-level examinations. Rumbi believed that teaching for examinations also prepared students to learn concepts. Rumbi said, "The A-level examination does not rely on memorization but on synthesis of information (int-1, July 29)". She added, "Learning for understanding does not mean students should not be prepared for their exams. Students should be able to synthesize scientific facts and also be able to apply what they learned." Rumbi provided an example:

Sometimes in an exam, they [students] are given questions and they are not directly what the students should memorize. But they should be able to apply what they have learned. From that you will see the student is able to comprehend and extract what they have learned (int-1, July 29, 1997).

Her view of synthesizing and applying was linked to the examination and not to real life instances. Though she appeared to have a broad view of what students need to learn, it was closely tied to the examination. Rumbi believed that students could learn this synthesis and application as well as the necessary facts while covering the syllabus. According to Rumbi, the syllabus had to be covered for the students to do well on the examination. In Rumbi's words:

Sometimes there are certain factors that will force you to do something that you know is not the right way to do. For example, active learning which will involve students a lot. When you look at some of these syllabi that we have in Zimbabwe, they are too long. If you use those methods quite often you will not be able to complete the syllabus. If you do not complete the syllabus, students will fail. If they fail, you are blamed. So sometimes, I know it is the right way, but because of these issues and factors you tend to brush aside some of the right ways of teaching (int-2, October 1997).

If the syllabus was not covered, students would fail and the teacher would be at fault. This statement points out a barrier in developing a new way of thinking about teaching and learning. While she wanted to use more active learning strategies, she believed that they took too long and they could get in the way of finishing the syllabus.

Rumbi thus created a dilemma for herself: to cover the material or use more activities. The two ideas could not be addressed easily, as the October quote above suggests. These two points were connected to different aspects of her teacher knowledge. For her, covering the material had a direct influence on the subject matter content and the activities seemed connected to the pedagogy. For Rumbi, one was the source of facts while the other was how to approach this body of knowledge.

While Rumbi was using group work, she also spent a great deal of time using past examinations. She said:

By using past exam papers, you want your students to get used to the format of the exam. Also you want them to get used to the timing system. If it is two hours, you take that paper and you make sure they finish in two hours. And also, as you know, English is our second language and you want them to get used to the language, especially in science (int-1, July 1997).

Rumbi put an emphasis on preparing for the format of the A-level examination. The language aspect also arose in talking about why she did not construct questions that the students could answer. Since the A-level examinations were still written in the United Kingdom, Rumbi was worried about the language of the examinations:

If I construct my own questions, I can use very simple language. English is also my second language. I can use very simple language, which they can understand, but when it comes to the real paper, then your students are struggling.

This focus on past examinations suggests that their formats were important for students to learn. Rumbi was concerned that the students answered the questions correctly. Her idea of synthesizing facts and applying them were linked to the examination questions and not to questions outside of the examination.

This focus on the examinations and its format could be justified if, indeed, the A-level examinations do require synthesis and application. However, chapter one indicated that these types of examinations focus on acquiring knowledge and not necessarily synthesis of facts. In addition, a biology professor at the University of Zimbabwe indicated in a talk with the biology resource teachers that many of the students who arrive at the University can not apply what they have studied at A-level. He complained that many new students could not measure chemicals or carry out experiments. Their A-levels clearly had not emphasized synthesis and application. Thus, Rumbi's view of A-level as requiring synthesis of facts and application may, in fact, be a faulty assumption.

Conceptions about Subject Matter

Rumbi continued to think of the knowledge needed as located within the examinations, texts, and biology syllabus. She was the transmitter of this knowledge. In her classroom, after discussions, Rumbi wanted the students to find the "right" answers. As I indicated earlier, Rumbi did not construct her own

questions because such questions would not follow the language of the exam. If she used simple language for understanding, Rumbi was concerned that the students might not do well on the examination. This language of the examination, for Rumbi, seemed closely tied to the knowledge to be learned. Rumbi was not ready to move away from this authority of what the syllabus and A-level examination encompassed both in terms of facts and question format. She did not grab onto SEITT's idea that students might construct their understandings of biology rather than just acquire knowledge from the teacher (Dewey, 1938; Driver, 1983; Tatto, 1999).

Indeed, when Rumbi talked about why she went to earn the PGCE at the University of Zimbabwe, she said, "I knew the content of my subject, my problem now is to tell these kids so that they can understand" (int-2, October 15 1997). Rumbi wanted her students to know the material and she wanted to learn how to tell them the facts.

Though her idea of understanding may take broad views, such as synthesizing and applying information, we see in her classes that she, in the end, told the students the answers. For example, in her class on April 1, though Rumbi provided the students with time to discuss biology topics, the answers were with Rumbi and not with the ideas generated from the discussions. On this day, I talked to Rumbi before class and she told me that the goal of this class was to cover the function of the kidney. She showed me the syllabus and the specific question she was addressing. Rumbi started the class by telling the students that they would be having a test soon and she added, "This is practice

for the A-level examination." She asked about the gross structure of the kidney, the assigned reading for the day. Many students provided ideas. Rumbi then put the students in three groups and assigned each group a different question. For example, one group had to answer what is being achieved through filtration. While the students were talking, Rumbi walked around listening to the conversations. After thirty minutes, one student from each group provided the group's answer. Rumbi listed the answers on the board and commented that the answers were not specific enough. She started listing her answers. There was no discussion of why the students provided the answers they did. Rumbi finished by orally summarizing the class.

While the students did discuss and exchange ideas, Rumbi had the answers that she felt the students needed. The discussions were opportunities for students to generate possible answers to the questions. The students presented their ideas and Rumbi listed them on the board. However, the students' answers were juxtaposed with Rumbi's own expected answers. She had the answers that the students needed to know, and she transmitted them to the students. Her conception of student-centered learning, as espoused in SEITT, was limited to having the students work together. Her view of learning did not extend to allowing the students to construct their own understandings. In a way, this fit with the way that Rumbi learned. She needed concrete products or guides.

Learning from Constructing and Applying

Rumbi's own learning, at least in SEITT, seemed to depend on constructing a teacher's guide and using it. She wanted a facilitating guide or plan to direct her in conducting a workshop. Rumbi provided an example when she talked about what she was not prepared to do in the SMCs. In the fourth and residential period, curriculum design was a main component. Rumbi said of this residential period:

I think we didn't have enough time and there was too much theorizing in designing of materials, too much theory. We never produced anything tangible. It was sort of rushing...I have got to source this to someone else because I wasn't equipped by SEITT at all in this area (int-2, October 1997).

Because she did not produce an actual guide to teach an aspect of biology, Rumbi sensed that she needed something concrete to feel prepared to talk about curriculum design. In contrast, during the third residential period, the resource teachers had produced the workshop materials including facilitating guides and handouts on the topics. They used these to facilitate the workshops. In this last residential period, they had created a format for curriculum design, but they had not actually created any topics using the design. The guides had unused and untested formats. Rumbi did not seem to feel that creating the guide provided her the sufficient preparation for understanding how to use the guide. Rumbi wanted a specific example to take away from the residential period. Without this concrete product developed around a topic, Rumbi seemed less confident of what she had learned.

It may be that Rumbi wanted her students to have accepted products when they left the class. In the classroom, this took the shape of the answers on the old examinations or of answers that Rumbi felt were correct.

Rumbi's Opportunities to Learn in the Project

In the project, Rumbi had opportunities to learn more about teaching and teacher education. These opportunities occurred during both the residential periods and the periods between, when the resource teachers had assignments. In many cases, these were group assignments. In the first assignment, between residential period one and two, all the resource teachers in a region worked together to interview Educational Officers and Heads of Schools. They also sent a survey to all A-level biology teachers to learn what these teachers felt they needed to learn. In this way, a great deal of the work outside of the residential period involved collecting and passing on information.

Communicating to and with Others

Communication was a quality that Rumbi mentioned as important in the project. She had to communicate with many groups during her participation. Her communication, though, as we will see, was more one-way than two-way.

Rumbi was selected as one of the SMC liaison persons in her region. In this role, she kept in contact with the head of the science department at the new SMC to coordinate activities, which included organizing the workshop dates, times, equipment, etc. Rumbi also attended organizing meetings for these events. Through organizing the SMC and the workshop, she discovered that

communication skills are very important. This communication extended to keeping teachers informed of workshop opportunities. Rumbi said:

I think one very important thing at the center is good communication because in the past sometimes, communication failed us a lot. Workshops would be called before and some of us would get letters two days after the workshop...I need to communicate with other teachers, say biologists, I need to communicate with them about the workshop, when we are going to have the workshop. Also I will tell them what the workshop is about, tell them the topic ahead of time (int-1, July 29, 1997).

While communication was important for Rumbi, it was a one way form of communication. She would tell other teachers about activities at the SMC. It is similar to the way she talked about working with students. In that case, she also talked about giving students the opportunity to exchange ideas and talk, but in the end, the answers were with Rumbi.

Communication in the residential periods between members of the biology group involved more opportunities to exchange ideas. This was particularly true with Residential Period Three, where the teachers actually organized a workshop for other teachers.

Working with Others In Preparing a Workshop

In Residential Period Three, Rumbi participated in organizing how to carry out a workshop. Much of the structure of these learning opportunities followed the model of presentation of theory, demonstration, practice and feedback. The residential period included lectures, presentation of new information, activities, discussions, group work, and rehearsals. The learning opportunities were varied.

SEITT planned to introduce and model strategies for the teachers to use in their classes and in the workshops. In a talk with the external coordinator, he indicated that he hoped the teachers would learn to help students with construction of concepts. He suggested that a variety of activities would help with this:

I believe that the more methods teachers are using to come to an understanding the better it is. I am not saying lecturing should not be done. Maybe in our case, with the sort of students we have, parents of students we have, headmasters, and teachers we have, we should not get away from lecturing. Conservative types of teaching could be excellent as long as it is done in a good way. Walberg has written a lot about this type of conservative teaching and how we should strengthen it (int-ext, August 6, 1997).

He wanted the teachers to learn new activities and, possibly, to learn to lecture in a different way. His discussion on active learning focused on the forms of teaching and not really on what the students were learning.

During the third residential period, many activities were introduced. For example, the lectures on subject matter were by University of Zimbabwe faculty in the Department of Science. These lectures were on genetic engineering and ecology. Another activity that was modeled was concept mapping. In this case, the SEITT staff member briefly presented new information and theory. In this activity, the word "curriculum" was used to help the participants generate ideas connected to this word. The SEITT staff member arranged these new ideas into different categories. Rumbi and the other resource teachers had the opportunity to participate in these activities as learners and later, they used some of the activities when preparing the workshop.

I introduced the content of Residential Period Three in Chapter Three. As I said, during the first week, the biology resource teachers learned about genetic engineering and ecology. Each resource teacher chose one of these topics and then two groups were formed with five members in the ecology group and eight in the genetic engineering group. Each group prepared and taught a lesson plan in the first week and, in the second week, the groups prepared the workshop for the regions. This involved putting together the material, organizing the schedule for the workshop, and doing a workshop rehearsal.

Rumbi was one of the eight members in the Genetic Engineering group. The rehearsal that Rumbi's group carried out, with the other biology group acting as workshop participants, was an important point of learning for her. This was more than role-playing because, unlike the lesson play role-playing, the participants were biology teachers just like the participants at a workshop. Thus, this rehearsal was a real preparation for the workshops in the regions. In this rehearsal, all members of the group had roles to play; however, in the regions, this strong support was not present.

The rehearsal during the last week was specifically a situation in which the resource teachers could try out their workshop on other biology resource teachers and make improvements. In her rehearsal, Rumbi was in charge of introducing DNA as the "engine of engineering". The following quotes are from a transcription of the video of the rehearsal.

Rumbi: Good morning ladies and gentlemen. ...well today, ladies and gentlemen, (writing on large paper ENGINEERING) if we say engineering without saying anything else, ladies and gentlemen. What comes to mind? Nothing?

Student 1: Making or structuring building

Student 2: Design

Rumbi: But ladies and gentlemen. When we think of engineering, we think there must be an engine. (writes GENETIC). We say engineering. There must be an engine. What do you think is our engine?

Student 3: Genes

Rumbi: But the molecular aspect that holds all the parts is DNA. So in order for us to be good engineers, we must understand the structure of this thing, the engine, which is the DNA. So ladies and gentlemen, let's get into it. What do biologists know about engineering? To make it more important our engine is alive. Right now, we must look into our engine in order for us to do the engineering. You'll get activity instructions and I want you to get into groups of two. (handout sheets). Please can you get into groups.

Rumbi started by asking the other teachers what they knew about "engineering". She tried to include the teachers from the beginning. Rumbi had already seen this method demonstrated several times in the residential periods. SEITT staff modeled this when the genetic engineering was first presented and during many other introductions to topics in the residential periods. Rather than talk about something new right away, she tried to find out what the participants knew and connect it to their own knowledge. Though she may have been leading the group to the answer of DNA, this rehearsal was the time to think about what the facilitators did and improve on it.

After the biology "students" did the activity and stuck their answers on large paper on the wall, Rumbi's excitement with this opportunity for teachers to take a lead in helping teachers shined through:

We can discuss. We are all free to contribute. As you know, this center is for us all. All of us. It is our thing. So be free. Never in Zimbabwe have we teachers had our own thing! I feel great!

Rumbi then performed a little dance. This was an expression of her enthusiasm to be part of a project that was preparing them--teachers-- to organize workshops that addressed teachers' needs. This was very different from the workshops these teachers had attended in the past. Most workshops were organized by the regional offices and involved an "expert" coming and telling the teachers about a topic the teachers often were not interested in. Rumbi realized that the workshop they were preparing to carry out was quite different. It would be run by teachers for teachers based on their own needs. She wanted her colleagues to know her feelings on this.

The rehearsal also included a critique. After the groups presented the limitations and benefits of this paper model, the leader of this DNA group, not Rumbi, said, "Is there anything you think can be done to improve this particular activity?"

Teacher 3: When we started, we did waste one or two minutes trying to separate the DNA and RNA. I think if you put them in papers for RNA together and DNA together. It saves time.

Leader: OK separate them. Actually, that was part of the activity.

Teacher 4: I was also thinking we could have one of DNA in white and other in different color.

Leader: That is another idea.

This rehearsal provided an opportunity for teachers to accept each other's critiques and to think about how these ideas might be used. Interestingly, the points they talked about were connected to the DNA-RNA paper models and how to simplify the activity. Ways of communicating with teachers was not part of the discussion and the SEITT staff member present also did not talk about the

language of working with colleagues. For both SEITT and the participants, the activity and its organization were central.

After this rehearsal, the group once more got together and revised their materials, taking into account the comments by the teachers as well as their own reflections on the rehearsal. Most of the changes in the materials reflected arranging for more time or rewording a direction to make it clear. For example, for the introduction of the workshop, the group wrote out an introduction to use at the workshops. It included:

In 1996, a context analysis of the teacher's needs was carried out. One of the major needs indicated was the content of Genetic Engineering, which was not covered in our syllabus during the course. We have not come to teach you but to help each other better understand the concept of genetic engineering and its principles. What do you think of when we say engine? (wrkshp-1, June, 1997)

The resource teachers added a bit more on the context analysis that the teachers had been surveyed on. On the program that they developed, this group also adjusted time. They increased the time for the DNA-RNA model construction from 45 minutes to 60 minutes while increasing the time for the lecture on genetic engineering from 20 to 30 minutes. These changes that they made did not address the content of the learning activities as much as the form. They were particularly concerned with arranging time.

Carrying Out Workshops: Sharing

The workshops were opportunities to continue learning as well as to demonstrate what they had learned in the project about carrying out a workshop. Rumbi carried out the workshop very similarly to the rehearsal.

In the workshops, Rumbi wanted to take the role of a facilitator who did not tell but who shared. She talked about this in an interview:

The person should be very open to the teachers who are coming to the center for help and also don't be a dictator, not at all. Because if you become a dictator, you are going back to the old way (int-1, July 29, 1997).

Rumbi demonstrated sharing through her introduction to the workshop and her participation with groups and providing one possible answer to questions that had many possible answers. In the first workshop she indicated that the workshop content is based on the needs-analysis survey that the teachers had filled out and then added that the resource teachers were here, "...not to teach but share." In the second workshop, she stated:

We are not looking for one person to talk. We are here to share ideas. At schools, we don't get chances to share. Ladies and gentlemen, we are here to share ideas, so feel free to contribute. It is our workshop. It is the first of several in biology. Maybe someday, you will lead this. Each member is free to participate. Last year we did a needs analysis and one topic was genetic engineering. So this workshop is to address that topic.

Rumbi wanted to be on equal footing with the teachers. She suggested that she did not want to tell the teachers content or ideas. Rather she was concerned with making the SMC and the workshops user-friendly.

In her work as a resource teacher, sharing involved generating ideas. During the second workshop, Rumbi introduced the DNA-RNA models and the activity of putting them together and working on limitations and benefits of the paper models. Groups worked on the activity following the activity sheet. In one group, a participant suggested that she might introduce the theory first and then

this activity using paper models. Another teacher put in, "How would you do the theory?" However, before this question could be addressed, another teacher changed the subject to limitations of the model. Rumbi, who was sitting with this group, added that this was only a paper model and another teacher suggested that the model did not show the spiral shape. Then Rumbi finished this conversation by stating that the paper model was five-sided and not six-sided and that this model could be used to familiarize students with DNA.

In this discussion, Rumbi shared one possible limitation and this was followed by another teacher's idea. This also occurred when teachers were responding to a question by Tendai, another focal teacher and Rumbi's partner in the workshop. He asked if the DNA-RNA paper model activity was appropriate for A-level students.

Teacher 1: Yes and no. Yes, it gives a reasonable picture and is easier to remember this way than in the book. It provides a visual representation.

Teacher 2: Maybe, but childish for them.

Teacher 4: For an introduction, it is good. There is more detailed structure.

Rumbi: It also helps to see how DNA-RNA are composed. Start with this model and on the exam students won't miss the question on composition; ribose sugar versus deoxyribose sugar.

Teacher 1: It takes time to prepare. If you give it to me, I will use it.

Teacher 4: If you ask students to make their own models, the results could be interesting.

Rumbi: One copy for you, then the students can improve.

Here Rumbi shared ideas with other teachers. They were sharing ideas concerning the practical aspect of using the model in the classroom and how the model itself could be improved. The participants were exchanging ideas. One teacher thought that using paper models was childish; another found them useful as visual representations; another suggested that students would learn a great

deal by making their own. In this discussion, the teachers were exchanging ideas around teaching in the classroom. Teacher 4 particularly was making use of this opportunity at the workshop to think about how students might make sense of this model and how it could help in teaching them. As the workshop was an opportunity for the resource teachers to share ideas, for Teacher 4 this discussion was probably a rare opportunity to talk about A-level biology students' learning with colleagues.

However, this exchange of ideas did not go into depth. Though the teachers exchanged ideas, they did not build on what each said. For example, in the one exchange when a teacher asked, "How would you build on the theory?", another teacher did not address this question but brought up other limitations. Also, when a teacher suggested that the models were childish, there was not discussion on why this was. Answers as to why these opportunities were not pursued can only be conjecture. One reason, however, might be that the teachers came to the workshop to gain activities to use in class and not necessarily to think more deeply about learning and how these activities could promote student learning. These teachers want an activity to take away to apply in their classes.

Indeed, recalling The Stages of Concern Model discussed in Chapter 1, the teachers who attended this workshop were being introduced to the activities. They were at the 0 INFORMATIONAL or 1 PERSONAL stages (Hord et al., 1987, p. 31). In most cases, they had not tried these activities and did not know how to talk about management and impact. These teachers were concerned that

their students learn biology, but at this time they were more interested in learning new activities than with how to use the activities to promote particular kinds of student learning in the classroom.

Rumbi, as the facilitator, also took this stance, providing the teachers opportunities to present their ideas but not probing them. By taking this approach, Rumbi felt that she could avoid being a dictator. Rumbi seemed to be in-between in her growth in thinking about teacher-teacher interaction. While she felt generating ideas was important, she did not want to be a dictator and tell others what to do.

The opportunities at SEITT may have limited how much she was able to grow as a teacher educator. Her talking to others was a new situation among A-level teachers in Zimbabwe, and she had not really learned about communicating with colleagues. Her awareness of not wanting to being a dictator was also new. However, she did not have the support and opportunities to more closely examine what these opportunities offered and their limitations.

What Does Rumbi Make of the Project?

Rumbi encountered many learning opportunities in this project. Yet, being resourceful in the way that she was, she did not always transfer to her A-level classroom what she encountered. She took aspects that she could directly put to use and that did not require a great deal of reflecting on their purposes. Thus, it is difficult to talk about what she made of the project without talking about what she decided not to grab onto. Separating them for discussion would be too artificial. There were at least two areas in which Rumbi was clearly thinking about

how the project was influencing her. They were in teaching and teacher education.

Teaching: In-between in Teaching New Ways

Rumbi seemed to be in-between in how she made use of ideas and activities that she had learned in the project. She was in transition between her old ways of teaching and new ways that made use of active learning. This transition was tempered by the fact that the A-level examination was at the forefront and her feeling that she must cover the syllabus and the questions that might be on the examination.

In teaching, she was in transition in how she organized students for learning and how she thought about learning. She put students into groups more than she used to. On the SEITT OUTTAKE Survey¹⁶ given by the SEITT staff at the last residential period, Rumbi wrote that before the project she had frequently used lecturing, practicum, and demonstrations. After the project, she preferred, "discussions in groups, plenary, and student-centered practicals." She added that the aspect of this project that improved the most was, "teaching skills e.g., student-centered learning because I discovered it is quite motivating to pupils."

As a resourceful teacher, Rumbi was putting students into groups to talk and to exchange ideas. From SEITT, Rumbi believed that she was learning to use more activities and to think about student learning. Rumbi was particularly

¹⁶ SEITT gave a survey at the first residential period and at the last residential period. The two surveys were almost the same. For the first survey, I was not able to see the responses for each resource teacher. However, I did see the responses for individual resource teachers for the last survey.

confident that she had changed in the way she thought about student learning.

Rumbi suggested that one of the things she learned most from SEITT was to think about student learning rather than syllabus coverage. She said:

I think SEITT helped me a lot because before this program I was more concerned with completing my syllabus... After I started this program, I realized that the completion of the syllabus is not the most important thing. You may complete the syllabus yet the students may gain very little. I may cover three-fourths of the syllabus yet my students may gain quite a lot (int-1, July 1997).

She talked more about the thinking aspect:

I used to deprive my students of the opportunity to exercise their own reasoning, because I wouldn't give them enough time to discuss and come up with some conclusions. I would make conclusions for them. But after this program, I realized that those were very negative ways of teaching. I changed a lot from being a dictator and now I can give them a lot of opportunities to exercise their own reasoning ability and from that, I also learn a lot. Because when you give them time to speak up, and say what they think, you are also learning and you can identify problems from that (int-1, July 1997).

Rumbi felt that she must provide students the opportunities to discuss ideas and that during these discussions the students should use their reasoning ability. Through the students' discussions, Rumbi could identify problems. Rumbi viewed her role as providing the time to talk and then identifying problems.

Rumbi had created a learning environment in which students discussed questions posed by the teacher. Students talked in groups and one student reported to the whole class. The construction of this learning environment suggests that Rumbi understood that learning could be beneficial in a group. Rumbi's beliefs about how to organize teaching were changing. Her general

pedagogical content knowledge was expanding to include putting students in groups. However, in this particular environment, the teacher still had the answers. The students' answers were written, but the answers of importance were from her and the syllabus for the purpose of passing the examination.

This focus on answers also arose when she went over a quiz. Rumbi let the students choose which quiz questions to ask the teacher to clarify. Rumbi thought that by letting the students choose the questions, she was stepping back from the dictator role to provide some student input. However, in the discussions of the answers, the teacher still had the right answers. In the interim case study that I gave Rumbi, I wrote about this. Rumbi's response was:

I would not think the type of discussion would be called an opportunity to come up with the right answers because after that very important discussion, a similar test was set and most pupils improved greatly. Also, remember that according to Joyce and Showers, it is important to use combinations of lecturing, demonstration, and student-centered methods of teaching. Student-centered alone without other methods can be very fruitless (interim case study, October 1997).

Rumbi continued to think of the knowledge as fixed and her role as providing it to the students. She pointed to Joyce and Showers as the authorities in how to mix strategies. Thus, she had two sources of knowledge: one for content and one for pedagogy. The content knowledge was contained within the biology syllabus and while Rumbi did think that involving students was important, covering the syllabus still remained a constraint as we saw in the earlier quotation, "Sometimes there are certain factors that will force you to do something that you know is not the right way to do" (int-2, October, 1997).

Through SEITT, Rumbi became aware that completing the syllabus might not necessarily promote student learning. Yet, this awareness was tempered by outside factors that might take time away from students covering the syllabus. She was trying to create a balance between the new activities espoused by SEITT and in the academic literature with her need to complete the syllabus.

Rumbi was in-between in the sense that she was in transition from a more directed approach to teaching to a more student-focused approach. She was caught between the exam/syllabus and new expectations of active learning that required more time for students to talk and less for covering the syllabus. The SEITT staff and the literature that she had read on active learning supported an approach that incorporated more activities. On the other hand, she felt constrained by the authority of the examination and the syllabus that laid out its key concepts. She had two authority groups coming from different sides, and she was in the middle trying to do a balancing act. In this position, she had decided to put students in groups to help them share ideas on different biology topics. However, the source of the answers remained with Rumbi and the other authoritative biology sources: the text, the syllabus and past A-level examinations.

One reason for this might be that she separated subject matter from pedagogy, as illustrated earlier in this chapter. Rumbi suggested this when asked about what she gained from SEITT: "As far as the subject matter is concerned, I don't think I have gained much from it. The teaching style, I gained a lot" (int-1, July 1997). She felt that she had improved her teaching style but not her subject

matter content. She clearly separated the two--content and pedagogy. She did not appear to understand that, for example, using the DNA-RNA models involved both an activity and subject matter. The activity was a tool that could be used to help students think about and understand particular concept in depth. Instead, Rumbi felt free to vary her pedagogy but acted like she had less freedom in the content area.

Rumbi was seizing onto part of the student-centered learning concept espoused by SEITT. As indicated in Chapter One, SEITT staff provided four elements of student-centered learning. They were (de Feiter et al., 1995, p. 41-42):

- more learning for understanding (less rote learning)
- more varied, interactive and activity-based learning patterns (less passive note-taking)
- more relational to natural and social context and to students' every-day experiences (less transmission of abstract theory)
- more attention to practical skills, process skills and problem solving skills (e.g. observing, raising questions, formulating hypotheses, designing investigations, drawing conclusions).

Rumbi was using interactive learning patterns by asking the students to discuss together. Within these discussions, students may have been drawing on everyday life experiences, yet in the feedback sections, Rumbi did not incorporate these in discussing students' answers. Her feedback suggested that she had the answers. She felt that the method of student-centered learning was accomplished because the students had discussed among themselves. Rumbi had seized onto varied and interactive learning, but not the other aspects that

involve teachers listening to what students had to say, connecting to students' experiences and problem solving. Indeed, from her comment in the last survey, she may view student-centered learning as a particular method rather than a perspective on learning. Rumbi stated how her teaching had improved, "teaching skills e.g., student-centered learning because I discovered it is quite motivating to pupils."

Her method of student-centered learning was based on student talk. However, it did not include ways of leading discussions to talk about students' ideas and to connect these ideas to the subject matter. Rumbi did not have opportunities in SEITT to develop this pedagogy. Her opportunities in SEITT involved using activities, but not reflecting on what students said or what they seemed to understand. SEITT staff seemed to want to help these teachers acquire these new activities and they did not pursue the elements as thoroughly.

The SEITT project, however, did talk about the other elements. For example, in the last residential period, a SEITT staff member talked about active learning and constructivism. He presented an incident in Zimbabwe that highlighted different value/belief systems that teachers need to think about when teaching (from the handout "What is Active Learning?"):

In one incident, in Zimbabwe, there was an international convention for electrical engineers (Oct. 1995). They were discussing about controlling lightning related deaths, and how the community could be educated. They invited some local members of Zinatha¹⁷ to explain the traditional lightning beliefs, with the intention of exposing these as fallacies. One Zinatha member

¹⁷ Zinatha is an organization in Zimbabwe that promotes indigenous medicines and indigenous views of healing from n'anga, whom we might call traditional healers.

explained how lightening could be "sent" to attack a villager even when there are just a few clouds. Some local engineers then objected saying that this was unscientific--so the n'anga challenged them to a demonstration--to which they all declined!

The incidence illustrates very well how two parallel frames of reference can coexist if the learner fails to resolve the conflicts--in this case--between a value/belief based knowledge system (lightning can be sent) and a scientific based system (lightning is a natural phenomenon). The electrical engineers demonstrated that despite their highly specialised knowledge in electrical phenomena, they were still not convinced that they could safely disregard their traditional beliefs about lightning. Thus when the conflict was thrust upon them in the form of a challenge, they were not prepared to call the n'anga's bluff.

IMPLICATIONS FOR ACTIVE LEARNING

It is important to identify the learner's value system in connection with the concepts to be learned. This again underlines the importance of ascertaining the pre-existing knowledge of the learner.

Learning tasks should be geared to challenging the value system so that the learner has to make a judgement.

This presentation included a story about how important prior beliefs are and how difficult they might be to change. This story was followed by a discussion among all the resource teachers. Batsirai, one of the focal teachers, suggested that one person might have ten parallel views that might include science, medicine, and a Christian perspective, among others. Thus, there was a discussion around prior experiences and how important they are to learners. Rumbi heard this, but for Rumbi, there were no opportunities to work with the other biology teachers on constructing a product associated with this. Additionally, Rumbi did not decide to participate in SEITT in order to change her beliefs about how her prior experience might influence her teaching. She is similar to many teachers participating in professional development projects in this

respect. As Wilson and Berne (1999) suggest, few teachers participate in professional development projects in order to change beliefs. Teachers typically want to learn strategies or content. Rumbi was no different. However, Rumbi is interesting for just that reason. She did learn to carry out a workshop even though this was not one of her original aims in joining the project.

Teacher Education: In-between a Teacher and Teacher Educator

SEITT provided Rumbi the opportunity to work with teachers as a facilitator and in this role, she also was made aware of a distinction between teaching and teacher education. In the project, Rumbi began to think about how teachers and students were both similar and different in how they learn and how they should be treated as learners. For Rumbi, there seemed to be three groups of learners: pre A-level students who need structure, A-level students and teachers. Students who have not reached A-level needed more structure and strictness from the teacher. Rumbi thought that A-level students and teachers both needed opportunities to generate and exchange ideas. However, she sensed a gap between working with teachers and working with A-level students:

Oh, it is different because at a workshop you are dealing with adults and you should treat them with respect. In a classroom, you are dealing with students and you know that age-wise and education-wise you are higher than them. So although you give them a chance to express themselves, you should not lose your key. Otherwise, you will end up with disorganization. At the workshop you are dealing with adults, you should also consider their feelings, you should also consider their advice or ideas. For example, if a teacher at a workshop says something wrong, no one says, "Ah, that is wrong." You will find a way of getting around it. Unlike in a class you can say to a student, "No, that is wrong." (int-1, July 1997).

This paragraph reveals a great deal about Rumbi and her views towards working with A-level students and teachers. Teaching in the classroom was not very problematic. Students needed chances to talk, but if a student was wrong, she would correct the apparent mistake. Thus, she approached teacher and student learning quite differently. Teachers are older and more educated. Their ideas needed respect. Even if a teacher did make a mistake, she suggested that she would find a way around it. Rumbi suggested that she must be careful when helping colleagues learn. She did not want to be the dictator when working with teachers. She wanted to respect their ideas and avoid conflicts. Rumbi was focusing on the particular demands of working with colleagues and sharing, but she was not thinking about how this would help them learn more about student learning and teaching. In her work at the workshops, she shared, but she also took a telling stance at times. Rumbi was changing in some respects, but she was also unaware that she was not changing in other respects. This left her in-between in her path to becoming a teacher educator as well as a teacher.

Summary

Rumbi is a good example of a teacher in the process of changing in a country that was still very conservative in its teaching. She was in-between as a teacher and as a teacher educator. What was most interesting about Rumbi was that she was rethinking her teaching. Like many teachers, she could have continued lecturing and teaching in the old ways that she had experienced both as a student in Zimbabwe and in the US. However, she decided to change her teaching and to try new ways of working with teachers and students. In part, due

to SEITT, she was thinking about student-centered learning and about having students participate in discussing biological concepts in groups. She indicated that this was quite different. However, she was only using part of student-centered learning while not using other elements. There is no easy explanation for this. Partly, it is because of Rumbi's conception of the A-level examination. She felt that the examination required students to gain abilities to synthesize ideas and apply them. She believed that through the group work, she was successful in helping the students in this respect. In her view, though, the examination remained central to learning and not the students. The materials on the examination were the authorized facts. Rumbi herself had not begun to think about how this knowledge was created and by whom.

It must be pointed out that the project did not provide the opportunities for her to delve into these aspects of her teacher's knowledge. The project, rather, had provided opportunities to learn new activities for the classroom and for work with other teachers.

This may be the key reason why Rumbi also was in-between in becoming a teacher educator. Unlike the role of teacher, this role of teacher educator or resource teacher, was new to her. She had learned about ways to organize workshops and had participated in residential periods in which she worked closely with teachers learning about the work of resource teachers and doing some of this new work. However, she did not have many opportunities to think about how to work with her peers. She reflected on working with peers in my interviews and knew that she did not want to be a dictator. She wanted to share

with her colleagues as equals, but she had not thought about what that might encompass and how her sharing might be limited. She had not made these opportunities educative so that they might help shape her identity as a teacher educator.

In summary, Rumbi was connecting to the SEITT project in some ways and not in others. It was not just a matter of Rumbi deciding to pick up on active learning activities because that was what she wanted. Rather, Rumbi did adopt these activities because they were presented in such a way that Rumbi could find a way to use them. Though Rumbi did not decide to participate in SEITT to help teachers, she did learn to carry out the workshops using new activities and new ways of interacting with peers. Her learning in the project was due to an interaction between what she brought to the project and the opportunities she had in the project.

CHAPTER 5 TENDAI: A TECHNICIAN WITH PEERS

I felt that I was lagging behind. The last time I did some schooling was 1987...So I just decided that I needed to do something. I didn't know what was in store. I just thought maybe it could take me somewhere out of the classroom. That is what I thought initially (int-1, July 11, 1997).

Tendai the Learner

In this quote, Tendai's desire to get out of teaching seems to influence what he decided to learn while a participant in the project. Thus, before examining Tendai's past experiences and participation in SEITT, we need to look more closely at his motivation to participate in SEITT.

Motivation to Participate in SEITT

Tendai's belief that that he was lagging behind his colleagues influenced not only his desire to join SEITT but what he decided to learn in the project. Tendai decided to participate in SEITT because he was lagging behind. This lagging behind takes two forms. First, he felt that he needed more education and he was hoping to get more education as he did when he entered the B.Ed program in 1987. The B.Ed. gave him the qualifications to teach A-level biology. Second, he felt like he was lagging behind his classmates who had attended the B.Ed. program. He suggested that most of them had moved out of the A-level classroom into other jobs. In this case, lagging behind referred to the fact that he was still teaching A-level and receiving less money than his classmates:

I will remain in teaching if I get a promotion to a lecturer in a teachers college. The one thing, maybe which irks me, is there are these guys which I went to college with, we obtained the same degree, they are in teachers colleges. In terms of remuneration, they are far ahead of me, so that puts me off. So if I

stay in the Ministry, I will stay if I am promoted. But right now I have started doing a different course [academic course], which is out of teaching with the intention of maybe this position. There are problems, remuneration wise and so-forth. So within the next five years I can't really say. I have those two options--to go or to stay, if there is a promotion (int-1, July 11, 1997).

The "different course" that Tendai referred to was not in teaching or education. He was trying to gain computer skills in order to work in the private sector. If he does not find a job in a teachers training college, he will leave teaching altogether. The quote above suggests that one of the main reasons he had for leaving A-level teaching was because he was not making the money that his former classmates were now earning. He wanted more money and a promotion.

The financial costs and benefits of teaching were no longer balanced for Tendai. As he pointed out, his friends had moved up in position and were receiving more money while he saw himself as stagnating. To Tendai, the time spent implementing new strategies did not warrant the costs. Recalling The Stages of Concern Model presented in Chapter 1, Tendai was gaining information at the 0 INFORMATIONAL level, but at the next level of 1 PERSONAL, he seemed to be viewing the strategies as not worth the trouble to implement (Hord et al., 1987, p. 31).

This is viewed as the practicality ethic of teachers (Doyle & Ponder, 1977-78; Fullan, 1991). Fullan (1991, p. 129) suggests that when teachers balance costs and benefits, money is a small part. Tendai, however, indicated that money was very important:

I think when I joined I was very keen to help students, and I would make sure, I would prepare thoroughly for my students. And I was very keen to help my students pass exams. But over the years, things have changed. I need to admit, I am not very keen about that. And it could be the conditions in which we are working. In terms of remuneration, I think it has tended to make me not work as hard as I used to. It has something to do with the remuneration (int-2, Sept 1997).

At the time of entering SEITT, Tendai had reached a stage in his teaching career where he was losing interest. He is not unlike many other teachers who reach this point where they want out of teaching and want something new (Huberman, 1989a). Huberman indicates that after 12-20 years of teaching, some teachers have a "midlife crisis" in teaching (1995, p. 199). In Zimbabwe, this crisis could be accentuated by the poor economic conditions of the country. Since teachers were civil servants, their salaries remained fairly low.

The above quote also implied that the quality of students had changed. Teaching was not as easy as it used to be. Tendai talked about why he was not very "keen" about teaching at A-level:

It is maybe because of the type of student we are having nowadays. They are no longer keen. If I compare myself and how I used to work with them, the type of student we are having you have to push him, to do school work. Because of that, the remuneration point and the attitude of students, I think my teaching has worsened, I have to admit (int-2, September 26, 1997).

As Tendai talked about his beginnings in teaching, he also mentioned helping students pass examinations. Since more students are now getting into A-levels than when he started, their marks on the O-level examinations are not as high as they used to be. Teaching now may, indeed, require the teacher to think more about the diversity of learners and their backgrounds. Tendai may be more

confident teaching to the examination than to the students. This is not to underplay the conditions of teaching, especially the salary of teachers. It is low. But in Tendai's case, the conditions take on great importance. As we examine Tendai the learner, his comparison of himself with others remains a key concern.

Educational Background

Tendai attended primary and secondary mission schools through A-level and then studied at a teachers training college. After teaching several years, he attended a one-year B.Ed. course at the University of Zimbabwe. This B.Ed. course aimed to provide science and mathematics teachers with the knowledge to teach at A-level.

When asked why he became a teacher, Tendai laughed and responded:

I did my A-level and I didn't qualify for the University of Zimbabwe. Then, at that time, I just thought of the option of going to teachers college. My family also wanted me to become a teacher. Because at that time, 1980, we hadn't been exposed to many careers. So I had to opt for teaching (int-1, July 11).

In 1980, the year of independence for Zimbabwe, educational opportunities were limited for Zimbabweans and the student openings at the University were few. Instead of the university, Tendai went to a teachers training college.

Tendai had been teaching biology for around fourteen years before entering the SEITT project. He had taught at a variety of school types: one year at a rural school, two years at a rural church school, and since 1989 at a former A-school in an urban area. Here he was head of the science department.

Prior Experiences and Beliefs

Tendai remembered little about his early experiences as a young student in Zimbabwe. What stood out was the separation of his learning of pedagogy and subject matter. They were learned at different times in different places.

Limited talk on experiences

Tendai became interested in biology in secondary school with a teacher who “made the subject interesting.” This teacher influenced Tendai to pursue biology. In Tendai’s words, “It is because of her that I decided, maybe, to pursue a biology subject, at teacher college, at university. It was maybe from her. I liked the way she taught” (int-2, September 1997). However, when asked to elaborate on what this teacher did in the class, he only remembered that the activities were excellent, but he was not specific. In the interviews with Tendai, he consistently did not take these opportunities to talk about his teaching. This was particularly true when talking about teaching and learning. When the topic concerned what he perceived as problems, such as remuneration or different jobs, he did talk in much more detail. He did not seem to think deeply about teaching and learning.

Learning pedagogy in college

Tendai suggested that he gained his pedagogy in teachers training college. The course was three years long, with the first and second years at the college. The third year he went out for practice teaching in a school at the beginning of the year and in the final term he returned to the college. During his one year of student teaching, he was the teacher in charge of the class. He was supposed to have a teacher at the school to whom he could talk for support, but at this time in Zimbabwe, there was a shortage of teachers and all the teachers

had heavy loads. In addition, at the secondary level, many teachers were former primary teachers who were unqualified to teach at the secondary level. Thus, Tendai probably had very little support from within the school. From his college, a lecturer did come out to observe him teaching one time. But Tendai said, "He just came once because we were very many and they and you can imagine visiting all the students scattered throughout the country" (int-2, September 26, 1997). Thus, he was on his own for the one year.

Tendai said, though, that the teachers training college provided him with the methodology to teach. He indicated that lecturers did talk specifically about active learning; however, they conveyed their ideas through lectures:

We discussed active learning during our theory and the instructors expected us to carry it out in the field. It was mostly theory. We discussed it. Very little modeling (int-2, September 1997).

The lecturers talked about theories of education, but they did not model the teaching. Even when Tendai was out doing his practice teaching, he had little support in his teaching. This problem with role models and support at teachers training colleges is a trend which continues in teachers colleges in Zimbabwe in the 90's (Nagel, 1992).

Yet, Tendai suggested that it was at the teachers training college that he learned to teach. He said, "In terms of methodology and so forth, I think most of the things we discussed at college (int-2, September 1997). Since methodology was discussed in the college, Tendai assumed that he had learned the methodology to teach.

Tendai did not talk in depth about the teachers training program and activities that he participated in. At times I did probe in order to gain a better understanding of Tendai's views of teaching and learning. For example, when he was talking about the teachers training college, I asked him, "What about interactive learning?" This is when he mentioned the discussion of theory in the college.

The teaching methods that he picked up seemed to have been transmitted by the teachers training college faculty to the students. He also said about college, "The main stress was more on the methodology of teaching than the subject itself. Although I had done the subject through A-level, here the new situation I was in was learning to become a teacher or something like that" (int-2, September 26, 1997). This is the only time he mentioned subject matter knowledge with the teachers training college. Instead, subject matter knowledge he associated with the B.Ed. program at the University of Zimbabwe.

Biology content from the B.Ed. program

After graduating from the teachers training college, Tendai started teaching. Two years later, he entered the B.Ed. program at the University of Zimbabwe full-time for one year. When I asked him about the B.Ed. program, his first remark was, "The first thing I have to comment on is the time spent. It was sort of a crash course" (int-2 September 26, 1997). He elaborated by saying that the classes were from 8:00 until 4:30 everyday. Thus, he started by talking about the problems associated with the course more than about the content and form of the program. He added that the course provided the participants the content to

teach at A-level. He said of this, "It is more adding to the content, to prepare for teaching A-level" (int-2, September 1997). I asked for more detail about this course. Specifically, I asked, "What about the methodology?" and Tendai's response was, "They mixed. I remember we used to do a lot of practicals." Once again, he provided a short answer to a question concerning teaching. Yet, Tendai suggested that the B.Ed. provided the subject matter knowledge to teach at A-level.

Conceptions of Teaching Biology: Taking Old Examinations

While Tendai talked about methodology and subject matter knowledge as gained in professional education opportunities, his starting point when thinking about learning and teaching was the educational system and the examination.

Tendai said of education in Zimbabwe:

The system of education we use we classify our students according to intellectual ability, the idea that they came to do form six because they passed some exams somewhere due to their intellectual ability. So I think that, in itself, makes it one of the reasons that they either pass or fail. You can't have someone who has failed. I don't think you will do much with him to make him pass. There is this saying that you can take the horse to the river but you can't make it drink. He is poor, you know he is poor. I don't think you will be able to do miracles on that person who has obtained Fs throughout. A student has to have high intellectual ability. Then the teacher comes in with his effective methods (int-1, July 1997).

This particular quote includes many aspects of Tendai's views about teaching and learning. It starts with the educational system in Zimbabwe but also includes the examination and the ability of the students. The quote suggests that the examination system sorts students and that the students who get to A-level have "high intellectual ability". Tendai implied that students' abilities do not

change over time and that teachers cannot alter them. Teachers can only help a student to some predetermined level.

Tendai's role was to help students reach this level as determined by the A-level examination. Doing well on the examination was in the forefront. Tendai viewed student success as, "passing the exam because that is why they [students] are here" (int-1, July 1997). He indicated that using past examinations in the classroom helped the students prepare for the A-level examinations that came at the end of two years in A-level:

We are preparing them for an exam, so you need to expose them to the style of exam, the style of marking and so forth. That is why I believe you use past exam papers, to expose them, to make them familiar with what will come (int-1, July 1997).

Passing the examination is the goal and a central path is practicing on old examinations. In this view, the students arrived at A-level ready to learn to take the A-level examination. As I will demonstrate, Tendai's role was to expose the students to the examination in order to make them familiar with it and to provide the correct answers that the students should know.

What Tendai said about the examination and preparing for it is corroborated in his classroom. I observed two lecture days and one practical or laboratory and all were focused on examinations. These observations were in July and the students had only been in A-level since April.

Tendai focused on correct answers on past examinations. He went over the exams to find out the correct answers and to learn how the examinations had

been graded by examiners. For example, on July 8th, students were answering questions on homework. Tendai read one question concerning the temperatures at which some enzymes worked best. Tendai asked students the answers to the questions. A student answered, but Tendai was not satisfied and asked the whole class for another answer. Tendai then told them the answer he wanted and spent four minutes giving details. Tendai asked another student the next question and this student read the answer from the textbook. Tendai responded with, "His point is good" and then provided his own answer, which was the examination's answer. Tendai went through the test and asked the students the answers, but he was looking for the answers that fit the old examination.

Tendai also pointed out how many points a question was worth. After one question, Tendai replied, "You need to increase the concentration of enzymes to provide active centers. If you answered along these lines, it is two marks" (obs-1, July 8, 1997). On another day when they went over a different examination from June 1996, Tendai pointed out, "Make point allocation as a guide" (July 11, 1997). The A-level examination papers include the number of points each question is worth. So when he said, "Make point allocation as a guide", he was suggesting the students look at the allocation and provide that number of answers. For example, the 1996 biological science examination asked students to, "Explain how a fish ventilates its gills." Following the question was "[5]" to indicate that the answer was worth five points. This means that five answers were needed. Marking scales for these examinations were also available and

these actually indicated what answers would be accepted. The old examination papers can guide a teacher by providing the answers and points allocated.

However, this particular class was in July, and the students had only been studying A-level for three months. Already, they were writing mock examinations. While using past examinations can help students understand the format of an examination as well as the concepts, it also depends on how the teacher approaches the questions. In Tendai's case, he was looking for the correct answers from old examinations and did not elaborate on the concepts involved.

This focus on examinations was also evident during the lab day on July 9th. The lab experiment was from an old examination. From my fieldnotes, I noted the problems that students had using the laboratory equipment. In this class, Tendai read the procedure and instructions aloud to the students while they sat at their desks. Then he sent them to the tables where each one was working alone. Right away most of the students did not know what to do. The students were expected to cut up a potato, put it into a tube and then add some chemicals. Many students were not cutting but looking around. Tendai got angry with students falling behind and said, "What are you doing? There is a syringe to measure. You can't tell without measuring". One boy at a corner table pressed the cork into the tube and broke the tube. He hid the broken glass and tried to figure out a way to go ahead. He did not ask for help. Tendai eventually came over and discovered the broken tube and gave the student a different cork and piece of glass tubing. In my notes, I noted that the students seemed to be having a great deal of difficulty with this practicum.

Tendai wanted the students to use the equipment but only told them what to do. He read the instructions from the original examination from beginning to end. He did not demonstrate and work with the students in groups or individually. He seemed to expect that, after the students heard the instructions one time, they would be able to use the equipment effectively. He thought that telling would suffice. When asked why he did not have the students work in groups in the practical, Tendai responded:

During an exam, it is best to expose them to that from the beginning. Later during the practical, I thought like there was a problem. I put two together and I found it very effective. I had not anticipated the problems we had. One idea behind that is that when students do the practical examination, they will do it on their own (int-1, July 11, 1997).

Although the examination was still one and a half years away, Tendai wanted his students to prepare for the examination by working alone to simulate the examination conditions. Despite the fact that these students were new to A-level, Tendai had not anticipated students having problems doing the experiment. Tendai was not drawing on his pedagogical content knowledge of how students understand biology. If he did, he might have anticipated from past years that students might have troubles working with glass tubing, burners and chemicals. Again, Tendai did not consider the learning styles of students when carrying out a class.

The examination also played a significant role in how Tendai evaluated student learning. Tendai implied that tests, in general, were the only real way to measure student learning:

The only alternative is that you could just look at the students and tell if they understood or not, but that could not be the true thing. But by you giving them a test they are providing feedback and you can use that. Oral types don't include everybody... but if it is a test, everybody is going to have a test, you get results (int-1, July 11, 1997).

Tendai relied on a limited set of ways to understand student learning. He felt that he could use testing or watching students. From a test, he could get results. Testing was fair, whereas looking at students in the class might not provide a true account of the students' learning. Tests, to Tendai, were fair because everyone was doing the same thing and "results" were the outcome. Tendai seemed to want the results of tests to evaluate students. He did not talk about processes of learning, but of results.

Tendai was aware that his professional education experiences had not prepared him to find other ways of helping students. Tendai thought that he had not had the opportunity in his own learning to experiment with different types of teaching. Tendai said, "It is difficult for us teachers to come up with our own questions. That could be the other thing. The majority of us are not trained with coming up with the question items" (int-1, July 1997).

In this statement, he focused on writing examination questions as a skill that he did not learn. Tendai did not see himself as prepared to deviate from past examinations and the questions on them. He did not talk about how his professional education had or had not prepared him to ask students questions about biology. It was the examination that he was most concerned with, and he did not think that his own professional education had prepared him to create his

own material. Tendai thought of himself as a transmitter of knowledge as expressed in past examinations and their correct answers.

It is important to make a distinction between his focus on correct answers on past examinations and the A-level syllabus in general. The A-level syllabus does elaborate on important concepts to learn. A teacher could use it as guide in deciding what to teach. Tendai, however, used past examinations and their answers in his teaching. He did not seem to encourage students to think deeply about the biological concepts and how they were connected to the students' lives and futures, as SEITT espoused. It was not that he was not aware of biology in the students' lives, because he said about student success, " Firstly, passing the exam because that is why they are here and then it could be, maybe, in life what they do" (int-1 July 11, 1997). Tendai was aware that students needed the concepts and ideas in biology for living in Zimbabwe. He just did not make this link in the classroom. One reason might be his own way of learning.

Tendai's Views of His Own Learning

As we have already seen, Tendai did not talk a great deal about learning. However, we know that he separated methodology from subject matter content. In his classes, he also saw his role as transmitting knowledge. When Tendai talked about his learning in SEITT, he did suggest that he acquired facts through lectures and shared ideas through discussions, "The mode of delivery was mostly lecture, lecture talk. But during our discussions during residential period, it provided me with alternatives" (int-1, July 1997). The mode of delivery by SEITT staff in the residential periods was multifaceted, but Tendai focused on the

lecture aspect for new facts or information. He associated the lecture with new ideas and facts. The discussions helped him think about and exchange ideas around the facts.

His past experiences as a student and in professional development were very lecture-oriented. He went through A-level in Zimbabwe, a system that includes tests along the way. In most classes, the teacher lectured to the students. Even in the teachers training college, Tendai indicated that the lecturers talked about active learning, but it was not modeled. He had few past experiences with active learning. However, the SEITT project did provide opportunities for him to become involved in learning and to organize learning for other teachers.

Learning Opportunities for Tendai in the Project

In the project, Tendai, like Rumbi, had opportunities to learn more about teaching and teacher education. He was involved in activities both during the residential periods as well as the periods between the residential periods when the resource teachers had assignments. However, he did not attend many meetings outside of the residential periods and was not a liaison person, as Rumbi was. This made sense since he did not plan on being involved in the SMCs. Tendai made it clear that he was not going to work at the SMC. "From the look of things I will not be involved...right now I can foresee a problem. The whole thing hinges on money. If you don't get anything, I doubt whether you will be interested" (int-1, July 11, 1997).

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Tendai did not connect his current studies in SEITT with work at the SMC. Rather, as already explained, he wanted to work as a lecturer in a teachers training college or in private industry. Thus, in the project, Tendai's learning touched on the classroom but was much more centered on teacher education.

Sharing and Thinking about Alternatives in the Classroom

While Tendai was not teaching differently, he was thinking about how teaching could be different in the classroom. In SEITT, he was able to interact with other A-level teachers and share ideas:

When you interact with their colleagues, especially those in your subject area, you could be having problems alone so when you meet others you share ideas and you ask from them how to go about getting your students to learn (int-1, July 1997)

Through talking with teachers and participating in SEITT, Tendai was aware of alternative views of teaching. SEITT provided opportunities for teachers to talk about learning. Tendai stated that he wanted to improve students' learning, but his specific concern was with problems that he might have as a teacher. When teachers think of collegiality as assistance, such as in Tendai's case, Little (1990b) suggests that this does not necessarily help teachers to rethink their teaching and purposes. Little says, "...teachers carefully preserve the boundary between offering advice when asked and interfering in unwarranted ways in another teacher's work" (p. 515). Talking about problems and how to overcome them may not lead to changing ways of thinking about student learning. When the focus is on problems and solutions, then the teachers will want to acquire skills or knowledge to address those problems. Long-term

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relationships based on inquiry into one's views of teaching and learning may not be of immediate interest to such teachers.

Tendai also seemed to maintain a view of teaching as telling. For Tendai, "getting your students to learn" could mean how to tell the students in different ways or how to organize learning differently. From what we have seen of Tendai, he was more interested in the former--telling the students in different ways. The activities that he learned at SEITT might not fit with his teaching in the classroom. If he wanted the students to remember the facts and scoring from past examinations, new learner-centered activities might not be that helpful. On the other hand, SEITT provided opportunities to work with other teachers and to learn to use new activities with them. This role was not as teacher but as resource teacher.

Learning to Facilitate Workshops: From Participant to Facilitator

During the third residential period, the resource teachers studied how to facilitate workshops in their regions where the participants were other A-level science teachers. In this residential period, Tendai learned to facilitate the ecology workshop. However, at the two workshops at the SMCs, he facilitated the genetic engineering theme. He switched because he and Rumbi were in the same region and they decided to do the genetic engineering for the workshops. This meant that Tendai had organized and practiced the ecology workshop in the residential period, but he actually facilitated the genetic engineering workshop in his region. The ecology group's main activity was a case study discussed in groups while the genetic engineering group worked on paper models and

discussed the limitations and advantages of this. Thus, Tendai essentially had to learn to carry out two different workshops.

Facilitating feedback in the ecology group

During the rehearsal of the ecology workshop at the third residential period, Tendai's role was to lead the discussion after the groups had discussed the Quelea bird problem.

In the case study on Quelea,¹⁸ the participants acted as senior pest control officers. The officers' job was to decide whom to help and why among three requests to exterminate Quelea. One request came from a subsistence farmer, one came from a local field officer from the Crop Protection Department who located Quelea in the area of a Government Development Scheme, and one came from a member of the Bird Control Unit of the government.

The actual question was, "You may only respond to one of these requests [for help to exterminate Quelea] because time and resources are limited. Which one do you choose?" The instructions also asked them to consider the reliability of information and the most needy request. Then the activity sheet said, "When you have made your choice prepare a report which justifies the decision and explains your proposed course of action."

Before Tendai facilitated the feedback session, another resource teacher introduced the case and started the group discussions. She asked the participants to read the instructions individually for five minutes, discuss in pairs

¹⁸ See Appendix F for more information on the case study on Quelea.

for five minutes, and then, in two groups, to reach a decision. This discussion took twenty-five minutes.

Tendai led the feedback session that covered twenty minutes and included the reports of two groups. Tendai started the session with:

Good morning ladies and gentlemen. What I want to do now is have a report back from each group. Each comes up and tells us what course of action they would take. So if we could start with group one for their report (transcripts of video from May 1, 1997).

After a representative of this group reported, Tendai said, "This group came up with attending to request two. If we could have a representative of group 2 come up." Then a representative of group two presented that group's findings. Tendai summarized this group's response:

Request two is first, then in terms of pest control, you could have 1 or 3... I think we are in agreement that the course of action we would take would be to assist the request for 2.

Here, Tendai put forth request 2 as the correct answer. This was also the answer that the case study suggested should be first attended to. In this way, Tendai summarized ideas and reached the conclusion quickly. He did not probe into the answers. He controlled the flow of the ideas. However, following Tendai's last remark, a participant initiated the following exchange that did examine the requests more closely:

Resource teacher 3: The first request is where conflicts will arise. The chief inspector decides. What conflicts with this one?

Tendai: He wonders what conflicts if request attended to first?

Resource teacher 2: They might think it is political factors.

Tendai: Political factors. Request two belongs to some government organizations. That could be a problem.

Resource teacher 4: But we are not told who the farmer is. He might be a councilor of the ruling party.

Resource teacher 2: Yes, but we can not assume what we are not told. If we are not told we can come up with other.

Tendai: We could say because these people... so I think assistance should be given to them first. I think it is better to give help to those who are trying to help themselves. But what about his family. The family he has to feed?

Resource teacher 4: Another assumption [all laugh]

Once this discussion of problems associated with the choice began, Tendai rephrased participants' ideas and promoted discussion. This occurred when he said, "He wonders what ..." and "That could be a problem."

After this brief discussion, Tendai concluded this part of the rehearsal by saying, "The first two [groups] are the ones to address after looking at the parameters we examined. So I think request 2 is most likely to be the one."

In this rehearsal, Tendai took on several roles. He rephrased ideas and encouraged discussions. On the other hand, he seemed to try to end the discussion before conflicting ideas were presented. It was only after someone suggested that there were possible conflicts that Tendai continued the discussion. As in his teaching, he seemed to want to reach the answer and finish the discussion.

With the ecology group, Tendai helped organize and led a part of the group's rehearsal. He was actively involved in putting this together. On the other

hand, he was only a participant in the genetic engineering topic at the residential period. He did not take a leading role in this group's preparation.

Learning from participating in the genetic engineering workshop

Tendai had four opportunities to be a participant in learning Genetic Engineering-- during the first week when the activity was introduced, at a lecture, when the lesson plan was presented and at the rehearsal. During the first week, a University of Zimbabwe faculty member lectured to all the biology resource teachers on genetic engineering. Tendai was present at this lecture. He was also a participant when the SEITT staff introduced the DNA model, he was a "student" in the lesson plan presentation, and he took the role of an A-level teacher in the workshop rehearsal.

When Tendai carried out the genetic engineering workshops in his region, one of his main roles was to lecture on genetic engineering and to facilitate the following activity. Thus, it is important to see what the rehearsal of the genetic engineering looked like.

In the genetic engineering rehearsal, the resource teacher who lectured on genetic engineering also spent a fair amount of time going over concepts with the participants. This resource teacher said, "Now together we want to list down as many terms related to genetic engineering. What are some terms?" He then wrote the terms that the "students" came up with (video transcription of rehearsal, May 1, 1997). The participants came up with many different words that they had learned in the lecture by the faculty member. Some of these included vector, plasmids, sticky ends, and carrier. After listing these terms, the resource

teacher lectured on Genetic Engineering. This lecture took thirteen minutes and was on the construction of recombinant DNA. The resource teacher suggested that genetic engineering was difficult because it was abstract:

Genetic engineering is one of the most difficult fields of engineering because of the nature itself. When you are looking at engineering, you are taking the abstract into the practical. But genetic engineering is so difficult to imagine because something will be cut in a cell and connected to another in a cell. So how then is this done? We are going to discuss this together. The techniques of cutting and joining of genes. The other problem is how do we teach this abstract concept to our students? How do we expect them to do it? (rp3, May 1997)

The resource teacher then used overheads and explained an instance of genetic engineering in making insulin, much as the University lecturer had done the week before. After the lecture, another resource teacher in the genetic engineering group led the activity of recombining DNA. This activity also used paper models and involved cutting a piece from one paper gene and attaching it to another. The participants discussed the advantages and disadvantages of using this model with students.

This whole activity turned out to be confusing to the participants. The instructions on how to cut the pieces of paper and attach them to other pieces was unclear. Twenty minutes after given the activity, the resource teacher asked, "Did you manage to answer the questions? How would this model help the learner understand Genetic Engineering?" The participants said "No". One added, "After finishing the model, we forgot about the question" (transcript, May 1, 1997).

After the group finished the workshop rehearsal, there was a feedback session on what needed to be changed. One comment was, "There was a problem with the instructions. We need to make the instructions easier to understand. The way they are there is a need to improve the instructions." After the rehearsal was completed, this group got together and rewrote the instructions. For example, in the rehearsal the participants had to cut out pieces of paper according to the following instructions to make plasmids or pieces of DNA: "Take a piece of lined A4 paper and divide it lengthwise into 10 strips each 2cm wide. Mark each strip as in the diagram below..." For the workshop, these strips of paper were already cut and marked. The participants could focus on cutting and reconnecting strips rather than making the strips. In this way, most of the adjustments made the model easier to work with.

Carrying Out Workshops

Tendai carried out two workshops in his region with Rumbi. Both workshops were supposed to have three activities, but each time they finished only two. The three parts were: construction of DNA-RNA models, lecture and activity on genetic engineering, and a case study on applications of genetic engineering.

In the two workshops, Tendai tried to promote sharing with the teachers who participated, and he focused on how these activities could be used in the classroom. Yet, as this section will show, while doing this, at times he intervened in order to reach the answers.

Sharing around the classroom

In both workshops, one of Tendai's responsibilities was to give a lecture to introduce aspects of genetic engineering. For most of the participants, this seemed to be a new topic because genetic engineering was not a core topic for A-level.

Like Rumbi, Tendai emphasized the sharing and the classroom function of the activity saying:

I am going to share ideas with you on the principles of recombinant DNA. Later there will be an exercise on an activity to use in your school. First, briefly over genetic engineering.

At the second workshop, he started with:

This is genetic engineering, ladies and gentlemen. We will look at principles of genetic engineering. I am not an expert, but just want to help each other. I will give a short lecture, then another activity, then look at report back session.

In both of these introductory remarks, he avoided being the expert. In the first, he talked about sharing ideas, and in the second he stated that he was not an expert. Both introductions included a reference to activities as central to the workshops.

The first introduction mentioned the use of the activity in the classroom. Tendai also referred to the classroom several times in the workshops. For example, after his lecture at the first workshop, he said:

The next thing is activity step 1 and step 2 on Activity Sheet 2. We are going to genetically engineer some insulin using paper models. You can do with your students. Go back to groups and we will issue out materials.

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Tendai suggested that this activity could be used with students. In this activity, the participants cut out pieces of a gene and recombined the pieces as a simulation of what really happens in the world of genetics. The questions on the activity sheet were: How would this recombinant DNA model structure help your learners to understand a) The DNA recombinant technology; b) Genetic engineering?

After this activity, a plenary of all the biology participants discussed what each group found. The following discussion also indicates that Tendai was connecting the activity to the classroom:

Group 1 representative: Models simplify reality. For me, this model reinforces the idea that DNA is the most important element in genetic engineering

Tendai: Do you think that this is appropriate for a six form class [second year A-level]?

Rumbi: Yes I do. It is cheap, challenging, practical and reinforces.

Tendai: Would you use it after covering genetic engineering to reinforce?
(All heads shaking up and down.)

Tendai asked questions that connected the activity to the classroom. He asked about the appropriateness of the activity and when they would use this activity. In this way, he was connecting the workshop content with the participants' own classrooms. At the second workshop, Tendai again asked how the DNA-RNA models could be used in class. He initiated this discussion with, "Do you think this type of model is appropriate for A-level? I am interested to hear the views of colleagues." The following exchange occurred:

Teacher 1: Yes and no. Yes it gives a reasonable picture and is easier to remember this way than in the book. It provides a visual representation.

Teacher 2: Maybe, but childish for them.

Teacher 4: For an introduction, it is good. There is more detailed structure.
Rumbi: It also helps to see how DNA-RNA are composed. Start with this model and on the exam students won't miss the question on composition; ribose sugar versus deoxyribose sugar.
Teacher 1: It takes time to prepare. If you give it to me, I will use it.
Teacher 4: If you ask students to make their own models, the results could be interesting.
Rumbi: One copy for you, then the students can improve.

The discussion focused on the classroom and how this model could and could not be used. Tendai actually took a hands-off role in this discussion, with the teachers doing the talking. Tendai let the ideas emerge in the discussion. However, he did not probe the teachers' responses to try to find out in more detail what the teachers meant. For example, what did the teacher mean when he/she said that "the results could be interesting." Or why did one teacher say the model was childish? Specific ideas were left unexamined. There were also times when Tendai seemed to end discussion, as the next section argues.

Answers and time

While Tendai did promote questions and participants' ideas, he also intervened a few times and ended the participants' active roles. Tendai's general view of facilitating a workshop was to organize the activities and then stand back. Since the participants were doing an activity, Tendai did not want to interfere. But when he saw things moving slowly, he took action. Tendai said of these activities:

I remember at one time I was working on the papers to hand out and Rumbi came to me to say why don't I go help that group. Initially, I thought it was an activity and I shouldn't be organizing things. (int-1, July 1997).

Tendai did not think that he should be involved in the activities. He let the participants come up with their own answers. Activities were what the participants were doing and he, as facilitator, should not be involved in their discussions. He may have viewed the times when he stood up front as his times and the times when the participants were working on an activity as the time for the participants to work without the facilitator.

However, there were several times when Tendai did step in, and these were often when Tendai viewed time as a factor. Once in the second workshop, he started providing the answers that he expected to hear:

By the time they came up with their group presentations, most of the things were said in the groups because we had become part of the groups rather than for us to have waited and then we could have come in with additions. During the discussions we sometimes provided some of the answers rather than providing the answers themselves. It is just like a teacher going to discussion where students are discussing and you provide the answers (int-1, July 1997).

He provided the answers before the participants had the opportunity to come up with their own ideas. He also remembered an incident when he saw a lagging group and talked to them like students:

I remember one thing at the second workshop. We were very far behind time, and there was one point when Rumbi was leading the first session and I kept on saying to her she is not looking at her time. And then I found one group behind. They hadn't recorded anything for discussion. I said, "How come you are still waiting? You should have gone over the questions." That incident in itself is how I would do with my students (int-1, July 1997).

From my fieldnotes, I found that initially the participants were talking about the paper models but not applying them to the boards. Tendai came over and

started sticking the paper models onto the board. The participants were handing him the paper models to apply. Thus, this activity, which was supposed to be a group activity in which the participants learned about making models, turned into a demonstration in which Tendai was just trying to get the activity finished.

In these cases, Tendai seemed more interested in getting the activities completed than in having the participants exchange ideas. The activities needed to be completed and, to that end, he provided assistance. It might also be argued that if the participants were far behind, the facilitator needed to make sure that the participants covered the content of the workshop. While this is true, the facilitator also needed to assist the participants in their learning so that they did not get stuck. However, we have already seen that when the teachers were doing activities, Tendai did not want to get involved. His vision of what and how teachers should learn seemed undeveloped. Activities were activities and he did not see how the discussions helped the teachers think about teaching and learning. These activities were for providing answers at the feedback sessions. When Tendai talked about the resource teacher and his/her role, this view also arose.

View of a Resource Teacher

Tendai seemed to view a resource teacher as an organizer. When Tendai talked about the role of the resource teacher, he mentioned ways in which the resource teacher could organize workshops and not specifically ways of promoting teacher learning. Tendai said of a resource teacher, "A resource teacher needs commitment, preparedness and organization" (int-2, September

1997). These qualities describe in broad terms what a resource teacher might do. Tendai did organize meetings and prepare and lead a workshop. However, the qualities are not ones that describe how a resource teacher would work closely with other teachers. For example, how would a resource teacher encourage teachers to think about their own educational experiences? How would a resource teacher promote constructivist learning? These skills and knowledge were not part of his conception of a resource teacher.

What Does Tendai Make of the Project?

Tendai wanted out of teaching at A-level and was looking for a position teaching in a teachers training college or in private industry. He hoped that his participation in the project might prove to be a step towards that aim. Since he did not plan on teaching much more, he did not focus a great deal on how this learning opportunity could help in the classroom. Additionally, since he did not plan on working in the SMCs as a resource teacher, he did not talk a great deal about being a resource teacher and that work. Instead, in this learning opportunity, he seemed to take away what he could use as a teacher educator. While resource teachers and teacher educators might both teach other teachers, he did make a distinction between them. The latter works in SMCs, and the former works in teachers training colleges or in the ministry.

Teacher Education: A Narrow Facilitator Role

Since Tendai wanted to become a teacher educator, He seemed to pay more attention to how the project could help him in this role. Tendai essentially

learned how to carry out both the genetic engineering and the ecology workshops.

In the role of feedback facilitator, Tendai encouraged ideas and listened to the participants' ideas. This was a new role that Tendai might easily transfer to teacher education. In the SEITT residential periods, SEITT faculty members often used it. In this role, the facilitator took a distinctive role in promoting the discussion. He/she stood in the front leading the group. This facilitating role might not differ a great deal between topics. For Tendai, it involved summarizing respondents' ideas, repeating ideas and reaching a conclusion. Thus, though Tendai had practiced doing an ecology workshop, he was still able to use similar facilitating skills to do the genetic engineering workshop. These teaching behaviors are not specific to biology but are general and could be used by teachers in most subjects. These were part of his general pedagogical knowledge (Borko & Putnam, 1995).

This role of facilitator was also connected to Tendai's views of teaching and learning. The subject matter or new information came from the facilitator in the form of telling. The activities, such as making paper models and discussing, were opportunities for the participants to accomplish a task. Tendai's role was to let them accomplish the task and to intervene when necessary to make sure the task was completed. In this way, subject matter was transmitted through telling and the activity was a time to share and come up with a response for the feedback session. Tendai did not grasp that the participants' ideas, developed while doing the task, could also be part of understanding subject matter. Hence,

the way in which he carried out the workshop was similar to his lab experiment in his class. He wanted the students to finish the lab and he did not seem that interested in the process of doing the experiment.

Concern with Facts

Participating in SEITT did not change Tendai and his view of knowledge. While he seemed confident of his knowledge for teaching students, he became concerned about how other teachers would view his knowledge and how it qualified him to be a resource teacher. To Tendai, authority rested in the examination answers in the classroom. He believed that he had more knowledge than the students in his own classroom and was not worried about being questioned there. In the classroom, he controlled the flow of information. As he said in the interview in July about the workshop and discussions:

During the discussions, we sometimes provided some of the answers rather than providing the answers themselves. It is just like a teacher going to discussion where students are discussing and you provide the answers.

Teachers provide the answers. However, he was concerned about how colleagues would view his subject matter knowledge:

Doing a workshop is with colleagues and there is the danger of treating them like you treat your students. That is the major thing I find different between the two. You may be lacking content that your colleagues, who are participants in the workshop, have. That could create, they might question how this one became a facilitator if he lacks content (int-1 July 1997).

In the workshops with teachers, A-level examinations were not the focus. Yet, he suggested that he was concerned about his knowledge of content compared to other teachers. He did not want his colleagues to feel that he was

not qualified to be a resource teacher because he did not have the subject matter content.

Though he had opportunities to be a facilitator with other teachers and to take on roles of telling, organizing groups and facilitating feedback sessions, his concern remained around content knowledge. This is despite the fact that in a workshop he made it clear that he was not an expert, but a facilitator. It may be that his past experiences as a student, in which teachers were always telling, continued to frame his thinking of what a teacher or teacher educator does. In addition, he wanted out of teaching and did not want to put in time learning new activities to use in the classroom.

Lagging Behind

What Tendai decided to learn from participating in the project seemed linked to his desire to get out of teaching. Connected to this lagging behind was his lack of interest in teaching and trying new approaches. It is difficult to say which caused which. Did his lack of interest in teaching result in a feeling of lagging behind his friends or did his lagging behind produce a lack of interest in teaching? It is clear, however, that together they were barriers to his using SEITT's ideas in his classes.

On the other hand, he focused on learning about becoming a teacher educator. He wanted to become a teacher educator. Many of the responsibilities of a resource teacher were similar to those of a teacher educator. The work around organizing a workshop, particularly, was similar to working with teachers. Tendai, however, did not view the resource teacher role at the SMC as a step

towards that goal. He seemed to believe that when he received his diploma his work with SEITT would be completed. He hoped that his participation in the project would be enough to get him out of teaching and into a new job. This may be similar to the way that attending the teachers training college got him into teaching and the B.Ed. program was the step towards A-level teaching. Finishing SEITT may be the next step to a new position in the educational system. As he said, "I thought, maybe, this diploma, I didn't know much about it, I just thought maybe it could take me somewhere out of the classroom" (int-1, July 11, 1997).

CHAPTER 6 BATSIRAI: REFINING TEACHING AND DEVELOPING AN AWARENESS OF COLLEGIAL TENSIONS

Batsirai was a teacher who was already incorporating the ideas of SEITT and constructivist learning into his teaching before participating in the project. As this chapter will illustrate, he was probing students for their ideas, he was using group work in which the results were further probed, and he connected their biology learning to life in Zimbabwe. Many of these strategies and views of learning could be connected to his own experiences as a learner. For Batsirai, the project was an opportunity to refine his practice as well as to learn more about working with teachers. Like Tendai and Rumbi, Batsirai studied how to organize a workshop and carried one out in his region. However, Batsirai's concern with his work as a resource teacher was less connected to the form and content of the workshop and more focused on relationships with the teachers and how to nurture them while avoiding conflict. Examining Batsirai as a learner and his learning opportunities in the project helps us to understand why he refined his teaching and worried about constructing and sustaining relationships with teachers.

Batsirai the Learner

With Tendai and Rumbi, quotations worked well in highlighting how they viewed their educational experiences and beliefs around learning in SEITT. Because Batsirai already had such a student-focused teaching practice, his conceptions of his practice and examples will paint a clearer picture of who

Batsirai was as a teacher as well as a learner. Thus, below I link his practice with his conceptions of teaching and learning. This is followed by Batsirai's educational background and how it seemed to influence his views and practice of teaching.

Conceptions of Learning and Teaching: Motivating Students to Learn

At the heart of Batsirai's ideas about teaching and learning was his belief in the importance of motivating students to learn. This view emerged when he talked about the source of student success. In the survey I gave at the third residential period, Batsirai indicated that the source of student success was student intellectual ability. Whereas most respondents connected this student intellectual ability to an internal factor in students, Batsirai was different. He explained that student intellectual ability had to do with the students' exposure to learning. The teacher needed to consider what areas of the country students came from, because the quality of teaching in schools was different. A student from a poor district school would have less exposure to concepts in biology than a student at a mission school. Batsirai felt that it was his responsibility to find out what students knew and did not know and to build on that. He said about the source of student intellectual ability:

I think it is more exposure, which may be part of the environment. It is what they have experienced, maybe before we started teaching them at A-level. It is very important because some of them come from different backgrounds, they come from different schools, they come from different homes, and what they have seen so far actually influences the way they respond to practicals and even the theory of education (int-1, June 27, 1997).

As a motivator, Batsirai thought he must find out about the students and what they already knew about the topics. How did he begin to do this? This connection to motivation started outside the classroom. He realized that students had lives outside of school and the teacher needed learn about what the students were doing and what they were interested in. In Batsirai's words:

One way of finding ways to motivate them is to interact with the students, so that you know what interests them at what stage of development. I think we need to interact with the students so we know what they like, their fashion, the stories they are talking about, life and maybe some of their expectations. I think those are some of the ways of finding out how to motivate them. If you start with something very abstract and talk about a spaceship and they don't know one and everything becomes bleak and they start to withdraw and that is it (int-1, June 27, 1997).

Batsirai was aware of the need to know whom he was working with, to know what interested the students. He was concerned with knowing his learners and what they knew, so that he could start with that point as he taught. Though Batsirai called this motivation, it was also a part of his general pedagogical content knowledge, specifically his knowledge of learners and his view that learners' prior knowledge needs to be a part of the learning process (Borko & Putnam, 1995).

For Batsirai, knowing what the students did outside of school in their everyday lives was also important.

You have to start from what they do so you have to know what is fashionable for them during that time. And if you go to them you start at the right level and off they go. They say, "Ah, he knows this way." You have this friendly atmosphere and then you can even introduce these foreign skills and they can master them and they know, "Ah, we can start here from where we are and then here"(int-1, June 27, 1997).

Batsirai was trying to build a learning environment in his class to promote learning. With this environment in place, Batsirai could let the students take on more responsibility for their own learning. Batsirai viewed students taking on this responsibility as part of student-centered learning:

Student-centered learning, to me it implies the student is actually directing his or her own learning process. In other words, the student has to be in control, one. And the teacher has to design teaching methods which will involve the students, in the sense that the students have something to do and the teacher not doing a lot of things. So I think student-centered means the student has to be involved in the learning process. The student has to do something instead of just sitting and listening to what the teacher says (int-2, August 1, 1997).

In such a class, Batsirai expected the students to work after class to study the concepts in depth and probe more into the class discussions. Batsirai expected students to take notes during the class as well as textbook notes after school. Batsirai said of these two types of notes, "They [students] have to integrate the two. In class we scratch the surface and give them direction" (int-1, June 27, 1997). Batsirai said that the students needed to spend time after school and to read in-depth those areas touched on in class.

In addition, Batsirai promoted group work, in which the students took on responsibilities in helping each other learn. Groups were more than a way to rearrange students; they were a way for students to probe each other's thinking. Batsirai said of groups:

Sometimes one student might get stuck with a problem and then you [the teacher] sit there and don't know what to do. So if they are in a group, we assume that one of them will kick off and open the minds of the others and they will start to see where they are supposed to go and maybe if they do that

they start sharing ideas and even those who thought they had no idea about solving the problem start opening up and enter the discussion (int-1, June 27, 1997).

This concept of group work endorsed the view that students would learn from each other. Even the students who initially had no ideas might, in this environment, begin to come up with their own ideas to share. It was the students' own thinking that was being used. What did this group work look like?

On June 27, Batsirai had the students use paper models to demonstrate how enzymes could breakdown a substrate. The students received paper models of substrates and enzymes. The students had to do two different activities in groups. First, they had phrases that described what was happening and they had to place these in the correct location around the paper models of substrates and enzymes. Some phrases were "two substances produced", "molecule of substance", and "active site". The students worked on this in groups and Batsirai walked around the room checking progress on the model. He did not give answers, but asked questions, such as "Why did you put that phrase next to active site?" Then, Batsirai wrote on the board two questions: 1) How does the model differ from the real enzyme molecules and 2) How are the processes illustrated by models different from the real enzymatic reactions?

After time for discussion, he asked representatives from two groups to come up and write their answers. The student for the first question wrote three answers: 1) real enzymes are in 3-D shape, whereas the models are in 2-D; 2) real enzymes can change shape to accommodate the substrate; and 3) real

enzymes are globular. After looking at the answers, Batsirai asked for other differences. When there were no responses, Batsirai added that size was different: real enzymes are smaller than the model. While Batsirai added his one answer to the students' list, by examining the students' answers he was also confirming that the student-generated answers were important. This was slightly different than Rumbi's use of students' answers. Rumbi supplied the complete answer whereas Batsirai merely added to the student-generated list.

On the previous day, Batsirai also used group work that led to a discussion on students' understanding of a concept. After talking about enzymes and how they change the rate of chemical reactions, Batsirai said, "Now take ten minutes and look at the general properties of enzymes in the tables. Have the group secretary write. Write general properties." The students moved into groups and were talking and taking notes. Batsirai then asked one group to write down its answers on the board and the other groups to add comments. One student wrote his group's answers on the board. The list included denatured by heat, effective in small amounts, each enzyme has a specific pH at which it can catalyze, are not affected by chemical reactions, protein in nature, and action specific substrate.

After talking about the first answer, this student said, "The second speaks for itself." There was laughter and Batsirai asked, "Can someone in the group help?" One of the group members started to answer but she had trouble explaining. Batsirai asked for more help and a student answered, "A small amount of enzyme works on a large amount of substrate." Then another student

said, "I don't understand." Batsirai took another direction to help the students understand. The following conversation occurred:

Batsirai: How about everyday life. How many students do we have in class?

Student: 22

Batsirai: OK, 22. If the number exceeds 40, we need 2 biology teachers. One A-level teacher can teach up to 20 students. I should demand more money. But a small amount of enzyme will work on large number of substrate.

In this part of the class, the students worked in groups and the ideas on the board were used to see what ideas students might be confused about. While the student had written "effective in small amounts", there appeared to be confusion on what that meant. Rather than provide an answer, Batsirai asked other students for help and found that there were some problems in understanding. Again, rather than give the answer, he used a metaphor connected to school to make his point. He was constantly drawing on the students' ideas from the group discussions and using alternative methods to help the students understand the ideas.

In addition to group work that drew on students' work and ideas, Batsirai also motivated the students by bringing the local context into his classes. He connected topics to the students' lives. The use of stories in Batsirai's teaching, a technique one of his own secondary teachers used, was one of the powerful tools for helping his students connect to the subject matter. Following is a two-way story he used to draw the students in as participants in an introduction to the topic of enzymes. The story stimulated the students to think about mediators in everyday life and how enzymes are a type of mediator in the body (ob-2, June 26, 1997):

Batsirai: Freedom fighters fought Smith. Freedom fighters won the war. But what was in between? Who were in between?

Student 1: The heroes, the mujiba [males who helped the freedom fighters] and chimbwido [females who helped the freedom fighters];

Batsirai: I was away from 1975-79; I disappeared. Do you also still write letters asking favors? Put letters in textbooks and hope the person will find it. Is this still happening? (Laughter with some saying yes and some no.) For example, if C wants to communicate to D. They might come across each other. If C has no guts, what does he do?

Student 2: Sends someone.

Batsirai: Right, let's say G. What do we call G in English? Or in French?

Student 3: Messenger

Student 4: Mediator, go between

Batsirai: Is it a bad thing in everyday life?

(Some students say yes and some no.)

Student 5: It helps.

Batsirai: If G helps, it is OK if G doesn't fall for C. Or until the problem comes back. What if you have a problem with mom or father? What do you do?

Student 6: Go through mother to make father aware.

Batsirai: If I go to my father, I might get kicked. So need to go through someone else. Where do they go in our culture?

Student 8: To tete [aunt from father's side)]

Batsirai: To correct aunt... (laughter) to work out differences. In everyday life, people go between to solve problems, so there is peace. Also look at biochemical reaction in same manner. Life, community, society. Biochemical reactions need aunts and go between. In biochemical reactions, who are major actors? (writes on board, BIOCHEMICAL REACTION, ENZYMES)

This use of a story was both historically based as well as linked to the new topic: enzymes. It was not just a story for the sake of a story. The story drew on students' knowledge of the war of independence, society and a scientific concept. Batsirai was trying to connect a Zimbabwean situation with a scientific concept.

This story was not just told and left. Later in this class, Batsirai referred to this story again saying, "One enzyme, one substrate. Back to mujiba. They can't go to Zaire and do the same."

Batsirai's students also testified to the power of Batsirai's stories. They indicated that the examples in society he brought up related to the concepts. One student said, "He is not the same as other teachers. He gives examples in society related to the concepts he is talking about." Another responded, "The examples are very practical. Things are realistic." A third added, "He links everyday society to concepts. In the end we get the overall picture."

Batsirai taught in a way that drew on what the students knew and allowed the students to interact. He enacted his view of student-centered learning with the student as central. Batsirai's view of learning in his classes also connected to how he learned as a student.

Batsirai talked directly about how he learned. He stated that he learned best through doing things and talking about them:

I learned by doing things and talking about things because I remember we had lots of arguments at school. Our hostel was notorious for noise at form 1-4 because we used to form groups and say talk about Maths, school work, social issues. So discussing and doing things was best for me (int-3, Sept. 18, 1997).

In this quote, Batsirai suggested that he learned best by doing and talking with others. In the next section, Batsirai's experiences in school are examined and we see that he did have many opportunities to participate in and talk about science.

Educational Background

Overview

Batsirai attended mission schools in Zimbabwe through O-level and went to Australia for his matriculation year and B.Sc. He describes his matriculation year as equivalent to the A-level in Zimbabwe. He earned his B.Sc. in Zoology in 1982 in Australia and returned to Zimbabwe where he had been assigned to work in the Parks Division. He did not want this job, so asked what other work was available. He was sent into teaching. He enjoyed teaching. After teaching for two years, he applied to the two-year part-time Postgraduate Certificate in Education (PGCE) program at the University of Zimbabwe and earned his certification¹⁹.

Batsirai had been teaching biology for around fourteen years when he began to participate in the SEITT project. He had taught at a poor rural district school for nine years before changing to a rural mission boarding school. At this school, the students lived in dormitories, as did most of the teachers. Batsirai lived on campus. He was head of the science department, soccer coach, and a house tutor, a role in which he helped students with their studies in the evenings.

Doing and talking

In Batsirai's experiences of education up to college, there were many instances of his doing science and talking science. In secondary school in Zimbabwe, Batsirai served as a lab assistant and made charts and apparatus.

¹⁹ Teachers who earned a B.Sc. degree had to earn a PGCE if they wanted to continue teaching.

He did things. Batsirai talked about his teachers providing opportunities for him to become involved in science in secondary school:

They tried to help us see or get an interest in science. There were lots of experiments, group experiments and individual experiments. And also the fact that when they saw that I was one of the students interested in science, the teachers started to use us [students] as lab assistants to make apparatus and charts. That gave us more hands on (int-3, September 18, 1997).

As a student, he was involved in science. He was exposed to group work and experiments. In addition, he actually constructed equipment. He commented about one teacher at O-level, "He was very practical-oriented, student-centered, solving problems, and all sorts of what we call natural teaching. Not using textbooks. He could use ordinary life in his teaching" (int-2, August, 1997).

Batsirai added that in form 3 and 4 of secondary school²⁰ his mathematics teacher told stories about history and current events to help connect the world to the topics in the classroom. These stories helped Batsirai remember school work so Batsirai thought that he would include such stories in his own classes.

Batsirai also discussed issues with other students. In Zimbabwe in lower secondary, he remembered talking with friends at night. He said, "I remember we had lots of arguments at school. Our hostel was notorious for noise at form 1-4. We used to form groups and talk about mathematics, school work, and social issues. So discussing and doing things was best from me" (int-3, 1997).

²⁰ Lower secondary school began after standard 5 and consisted of Form 1,2,3, and 4. Form 3 and 4 are the two years before A-level.

Batsirai's experiences in Australia provided him an opportunity to continue learning in groups, as well as to take responsibility for his own learning. He said that the Australian education, at that time, was student-centered (int-2, August 1, 1997). About the matriculation²¹ year, he explained:

²¹ Batsirai talked about the matriculation year as equivalent to A-level in Zimbabwe. Though it was only one year, he suggested that it did prepare him for the university.

The school was experimenting with an independent style of learning. Students were given guidelines to follow and then they were expected to study and learn on their own, and going to the teacher for confirmation that they had learned the material (int-3, September 18, 1997).

This style was quite different from the style he was used to in Zimbabwe. Of this experience, he added, "So when I started it was a bit unusual, but after a few weeks I got used to it because we got into small groups."

This matriculation year presented Batsirai with a very different perspective on both teaching and learning. The teacher was not standing in front teaching. Instead, the students were expected to learn the material on their own and in groups. The students talked to the teacher when they had trouble understanding ideas or when they wanted to check their understanding.

Acquiring subject matter: University and professional education

Batsirai actually talked very little about his university and professional education. When asked about his experiences in the university in Australia and the PGCE program in Zimbabwe, he talked about the matriculation year. When I asked him if the university program was similar to the matriculation year he said that it was not. "The university was just like all universities. These lectures and then three hour practicals. The matriculation was more student-centered" (int-3, September 18, 1997).

I asked him specifically about the PGCE program and he mentioned motivation. "It was part-time. I think what stands out is ways of motivating students. We had one lecturer who advised us on how to motivate students so that they get interested" (int-3, September 18, 1997). Here again he spoke of

"motivating students" rather than his own motivation. He said of one teacher, "She was young and energetic. She would jump around and remind us of what we should do in the classroom to motivate students and prepare the lessons". Though he did not provide details, his idea of motivating students was one aspect of his student-focused perspective that permeated his view of teaching. In the PGCE, this was what he also remembered. Batsirai added though, that most of his pedagogy came from his matriculation year, that is, through his own apprenticeship of observation. He said, "The PGCE and university education helped me with the subject content at A-level; but on the methodology, it was matriculation that influenced me" (int-3, September 18, 1997).

Batsirai's early school experiences provided him with opportunities to engage in his own learning. In Zimbabwe, he worked in groups, carried out experiments, constructed equipment, and solved problems. In Australia, the matriculation year was, in Batsirai's own words, student-centered. At this time, he continued to take responsibility for his own learning. Teachers did not lecture. Rather students studied science independently and in groups and talked to teachers to clarify their ideas or to check their learning. His early experiences as a student and his matriculation year helped to shape his view of teaching and learning that incorporated the concept of a learning environment for students to learn and think about their ideas. These views are illustrated in the vignettes in his classroom. Batsirai was a teacher who used many constructivist ideas in his own classroom. If we used the Stages of Concern model to examine where he was located, it would be at 6 REFOCUSING because he was using constructivist

ideas and finding new ways to improve them (Hord et al., 1987). Additionally, Batsirai suggested that one reason he decided to participate in SEITT was to work with other teachers in thinking about how students learn.

Reasons to Participate in SEITT

Batsirai indicated that he decided to participate in SEITT so that he could interact with other teachers and become a better teacher:

I just wanted to work with other teachers. I enjoy working with other teachers. When we work together we exchange ideas, we exchange problems, and I think, maybe, that will make me a better teacher so my students will pass at the end. I think that is it (int-2, August 1, 1997).

Among these three resource teachers, only Batsirai included working with teachers as a reason for participating in the project. Batsirai wanted to share and work with others as he did in his own education both in Zimbabwe and in Australia. He wanted more contact with teachers.

Batsirai hoped to work with teachers, improve his teaching and help his students pass the A-level. Batsirai connected his teaching with students doing well on the exam. He understood that his teaching influenced the students' learning. He was very much concerned with his students doing well on the examination and learning biology, as his inclusion of "will pass at the end" suggested. Batsirai saw a clear link between his students' success in biology and his own professional development, which could be informed through working with other teachers. Rumbi, Tendai and Batsirai all wanted their students to do well on the examinations. However, when talking about student leaning, Batsirai did not

focus exclusively on the examination and tests as Rumbi and Tendai did. Batsirai also considered the students' ideas and how they arrived at these ideas.

Learning for Batsirai in the Project

What Batsirai decided to learn from the project seemed to have less to do with the explicit aims of SEITT-training resource teachers to take charge of SMCs and organize workshops-and more to do with his current needs as a teacher and a potential teacher educator. While he did learn how to organize and carry out a workshop, he also became more aware of ways to refine his practice and of potential problems connected to working with peers. I start by describing how he refined his beliefs about practice in the classroom and then examine what he learned about doing workshops and the issue of working with peers.

Refining Beliefs and Practice

Batsirai indicated that SEITT helped him refine what he was then doing in the classroom. Before participating in SEITT, Batsirai was already using many strategies that SEITT espoused. For example, in one of his classes, students worked in groups using paper models of enzymes to understand how these enzymes functioned. This was similar to a SEITT strategy. Batsirai indicated that he had been using these paper models for two years. "I made them myself. This is my second year and I also use it at lower forms" (int-1, June 27 1997).

Nevertheless, Batsirai felt that SEITT provided him new insights into learners and how they differ. In one residential period, a SEITT staff member made a distinction between problems and tasks. The instructor explained that problems were situations in which the answer was not known and the students

needed to find the answer. On the other hand, tasks were routines that did not involve solving a real problem, but merely finding out what the teacher already knew.

Batsirai said of this:

I was made aware of things that I had taken for granted. What is a problem to one child may not be a problem to another. So I have to be very careful when I give them work to do (int-3, September 1997).

We have already seen that Batsirai tried to construct an environment in which students could work with their ideas together and in groups. This presentation by a SEITT staff member stimulated Batsirai to reevaluate how the activities he used in his classes also need to be considered as the students might conceive of them--as tasks or problems. This interview came near the end of my stay in Zimbabwe and after the residential period when this problem-task differentiation was introduced. However, during this residential period much more on curriculum design was presented. Nonetheless, Batsirai grabbed onto this idea because he felt that it could improve his teaching practice. This learning about the difference between problems and tasks was not a specific teaching behavior but a perspective on teaching. It refined his current practice.

Participating in SEITT also helped Batsirai re-focus on the students and their learning. Batsirai said:

I think the SEITT program has helped me focus on the student-centered methods of teaching that we need to use a lot of them. I was trying to use them but sometimes I would ask myself, "I have a syllabus to cover." Each time I feel that I may be lagging behind I would do away with student-centered methods because they are time consuming and I would use the rush rush

method, lecture, lecture, lecture. You cover more ground and then, maybe, when I know that I am comfortable, I would go back. But now, I think, I have learned that if I use more of the student-centered method, I know that it is slow, but eventually I think that the students will gain more because they will be involved in doing things. So I think the SEITT program has reminded me that we have to, even if I am behind the syllabus, I should use a lot of these student-centered methods and also the problem solving part of it. So the students are involved in the thinking process not in recording (int-1, June 1997).

The above statement reflects a view of the importance of keeping students involved in the learning process. SEITT's focus on student-centered learning converged with Batsirai's and supported his own efforts at providing students the time to work together and learn. Parts of this quote, actually, might have come from Tendai or Rumbi. All three of them mentioned the importance of student-centered learning. However, Batsirai did not just talk about the time that student-centered learning activities need. He also talked about involving the students in the "thinking process," something that SEITT talked about but did not model. Batsirai understood that students needed that opportunity and time to think about biology.

At this point in his teaching career, Batsirai was focusing on ways of fine-tuning his teaching. Burden (1990) summarizes research on stage theories of development that point out this readiness at different times in a teaching career to focus on different teaching concerns:

In general, teachers in the early stages need much assistance with the technical skills of teaching and would benefit most from a highly structured, directive staff-development program. Practical information and application would be most useful. Teachers who are a little more advanced developmentally would seek information to add variety to their teaching and would prefer a collaborative approach to staff development and supervision. Teachers at the highest developmental levels would focus on more complex

and crosscutting concerns and would prefer more team types of arrangements and staff-development programs that are non-directive (p. 323).

Batsirai's needs at this point in his teaching career were less on technical skills and more on finding ways to help students learn. He was doing more than adding variety; he was concerned with helping students think and learn. This fine-tuning of a distinction between tasks and problems fit into and even strengthens his way of thinking about teaching and learning.

Batsirai was reminded that the students needed to be solving problems and thinking, even if it took time. While Rumbi faced a similar problem about time and group work, she was different than Batsirai in one important respect. Rumbi was not using activities in the same way as Batsirai. In Rumbi's class, the students talked in groups but the responses were not pursued. In Batsirai's class, the students' answers were used for further learning. The students ideas were used for understanding the concepts. It was not that Rumbi did not try to involve the students more. Rather, her past experiences in school and in professional development did not provide the opportunities to use the activities in class as Batsirai had. In Batsirai's past, he had helped construct biology material, he had discussed science with friends, and he had heard stories connecting science to everyday life. In a sense, Rumbi and Batsirai were ready to learn different aspects of teaching and learning.

However, the workshop was something new to Batsirai. Like Tendai and Rumbi, he was also stepping into new territory.

Workshops: Organizing Activities and Thinking about Colleagues

In the third residential period, the focus was on organizing and practicing a workshop that would be carried out in the regions. Like Tendai and Rumbi, Batsirai learned the details of putting together and carrying out a workshop in the region. As this section will show, he also conceived of this role as a technical activity of following the schedule. However, as he worked on this activity in the residential period, he became aware of problems of working with teachers.

Learning to do a workshop: Peer tension

Batsirai and Tendai participated in the same group during the third residential period. Both were part of the ecology group. The residential period provided Batsirai the opportunity to work with other teachers around creating and organizing a workshop. While Batsirai did carry away the finished format of the workshop to conduct in his region, he also became aware of tensions involved with working with peers.

In Residential Period Three, he helped prepare the lesson plan, organize the workshop, and took part in the rehearsal. In this rehearsal, the group introduced ecology and used wordwebbing, a strategy learned in the residential period, to find out what the participants associated with the word "human activities." Then the group led a case study of the problem of Quelea birds and their influence on the environment. The group used the answers from the Quelea case study to investigate how answers could be marked on an A-level examination. This was an activity to learn how to write a marking scheme or to decide on how many points for each answer. After each section, there were also

feedback sessions to hear from the participants how the rehearsal could be improved.

Batsirai's specific role was to lead the word webbing activity. He wrote "HUMAN ACTIVITIES" on a large paper and asked the participants to suggest effects on the environment. He had the participants work on this individually and then asked them to share their answers in groups. During this time, he and the other members of the group walked around to see how the participants were doing. Then Batsirai asked the groups to report their findings. The presentations by the groups were fairly rushed with Batsirai writing the ideas on the board. Without discussing the ideas that were written on the board, Batsirai said:

We are mainly interested in agriculture, so we would like to focus our attention on man, in terms of what he does. We need to go to the pesticides to see what these pesticides are used for and after that the effects on the environment.

The next person in the ecology group took over to introduce the case study. Batsirai's participation as a facilitator was limited in the rehearsal and he really did not interact a great deal with the groups. He gave directions and wrote the group's answers on the board. He did not lead a discussion of the answers. However, after the ecology group finished the rehearsal, the members gathered and revised their handouts and schedule. These revised documents were what they used at the biology workshops in the regions.

While the residential period provided Batsirai the opportunity to work through the rehearsal and develop a workshop schedule, working with the other

resource teachers made him aware of potential problems of working with other teachers. He talked about working with resource teachers:

I have learned to be tolerant. I learned to be tolerant to other people's views and to be accommodating because it was very tricky. Sometimes you think, "Ah, I don't care about other people", but you have to work with them and you have to accommodate them even if there are, let's say, personal differences and you don't agree totally with what they say or do but they are very emotional and this and what not. You have to accommodate them. This has taught me to be very tolerant, especially in discussions (int-1, June 27, 1997).

Batsirai talked about being tolerant of other resource teachers' ideas and accommodating them. He suggested that this was particularly true in discussions. He added that this was also true with working with the resource teachers in his region when organizing the workshops and setting up the SMC:

Even at the resource center when we are having meetings, when we are organizing, when we were organizing this workshop and maybe talking about those group reports that we write...And when we give each other responsibilities, like you do that, you do that and I do that. You find one of the RTs lagging behind; they are dragging their feet so you have to find a way of saying, "Hey, can we go ahead." Otherwise we won't finish, so we have to minimize friction.

Again, Batsirai talked about minimizing friction with other resource teachers when working on assignments in the regions. In this same interview, Batsirai also talked about the problems of working with colleagues in his own school:

That interaction with the RTs also has a bearing on the way of running the science department at my school. I am the head of the department and, just like interacting with your peers, assisting teachers in a department can give the same problems as with other RTs. You are interacting with your peers; it is almost the same. So that has helped me to smoothen out the differences even with my own teachers in the department.

At this time, I did not probe this answer, but when I sent the case study for Batsirai to respond to, I also asked him about working with teachers in his school. He sent back two written pages describing a specific incident with a new teacher who, it seemed, wanted his position as head of the department. In the science department, this teacher talked about how other schools were running their science departments and complained about Batsirai's school. Batsirai wrote, "I listened to a lot of his stories and tried to inform him about the unique problems at every school." However, this teacher began to bypass Batsirai and talked to the headmaster and deputy headmaster on issues, such as ordering equipment and books. He also reported tea time discussions to the headmaster. Batsirai wrote, "Despite all this, I continued to work and relate to the teacher as if nothing was happening between him and myself." As conditions worsened, Batsirai considered quitting. "At one time, I actually wanted to leave the school, but for the sake of the A-level exam class I had, I stopped and opted to adjust to the conditions of working with an assistant teacher who hates me as a person." Batsirai, then added that this teacher attended the SEITT workshop and began to change. "After this he came to me and opened up to me the benefits of the workshop. Slowly this teacher is fitting into the department which I think is a healthy situation. If I had left the school, maybe this would not have happened."

In this situation, Batsirai's patience and avoidance of confrontation seemed to have paid off since the teacher, according to Batsirai, began to fit into the department. Batsirai's laid back way of handling the situation was successful

in helping this teacher become a part of the department. Batsirai, as we will see, also used this "wait and see" attitude in his work with other teachers.

Organizing activities in a workshop

Batsirai's workshop followed the rehearsal closely, although he did not have enough time to discuss how the Quelea case study might be used for checking marks on the examination. In carrying out the workshop, Batsirai went through the steps that he had practiced in the residential period.

Batsirai was the only biology resource teacher in his region and thus had full responsibility for running the Ecology workshop. Batsirai, similar to Rumbi and Tendai, also linked the topic to the syllabus. After handing out the materials with the activity sheets, Batsirai linked the topic to the syllabus:

OK on page three are the aims. (He reads them). Ecology is part of the core syllabus. Most of the overlap of ecology and the option is in agriculture. From the syllabus, the areas that highlighted are these... (workshop, July, 1997).

Batsirai then read the parts on the syllabus. One teacher pulled out a syllabus that he had brought with him and looked at that. Batsirai linked the content of the workshop to a specific option on the syllabus.

Batsirai also made it clear at the beginning that he was a colleague and not a deliverer of knowledge. He emphasized the need to share ideas and exchange views. In Batsirai's words, "I am not here to deliver the goods but to share and to talk about problems we face. We should assist each other on these activities" (workshop, July 1997). He used wordwebbing to introduce the Quelea case study; however, he changed the phrased from "Human Activities" to a

phrase more closely connected to the topic of the case study, "Crop Production and Effects on the Environment."

Through this word webbing, one of the words that the participants came up with was "pests." He asked them to provide examples, and the Quelea bird was named. Batsirai then introduced the case study concerning the Quelea and its destruction. Within the case study, he followed the rehearsal quite closely. He introduced snowballing, where a pair begin discussing the case and then two pairs get together to talk and then two groups are formed to discuss the questions. As the groups discussed, Batsirai played a passive role. Batsirai walked around and listened to the discussions, but he did not try to direct them. He let the ideas emerge from the discussions without interjecting his view.

After the two groups had discussed for thirty minutes, Batsirai asked the groups to present their results and justifications. Batsirai provided each group with some large pieces of paper and a marker so that they could write down their findings. Each group had a representative present the group's findings in about ten minutes. After these presentations, it was one o'clock, the time for the workshop to finish. Batsirai ended the workshop rather abruptly saying, "I hope you use this approach in your school. I have learned a lot from you. I hope you come again." There was no discussion on how the participants might use a case study in their own classes.

As in the rehearsal, he did not discuss the feedback session itself. Batsirai played a rather technical role of deciding when activities started and stopped and of listing ideas generated by the participants, colleagues. He did not really probe

in to responses from the participants. This was quite different from his own classroom where he did ask the students to explain their answers. In the workshop, he was hesitant to really work closely with the teachers.

Learning about Teachers Versus Learning to Work with Teachers

Through working with other resource teachers in the residential period and with teachers at the workshop, Batsirai seemed to become more aware of teachers as learners and as peers. As learners, he discovered that they were similar to students. As peers, he concluded that caution must be used in interactions. Following is an example of an incident that made Batsirai aware of teachers as learners.

During the workshop, Batsirai had listed on the board birds that are pests in Zimbabwe. On the list on the board, Batsirai circled two words: Quelea and a Shona word for Quelea. One group had included both as different pests. The following discussion occurred:

Batsirai: How can one group put Quelea together with the Shona name and the other put them as totally separate. How can we address this?

Teacher 1: Use one language.

Batsirai: What if I go to Binga [a western part of Zimbabwe] and talk about it. English is not known.

Teacher 2: Bring an actual specimen.

Batsirai: Many things go by five names. A specimen would have done it. I had hoped to bring one but...

There was a "mistake" in language. Batsirai did not merely say, "You have one word for Quelea in English and one in Shona. That is wrong." Rather Batsirai addressed the language problem that teachers might face in school and suggested a way to avoid such a problem--bring a specimen. In fact, Batsirai had

contacted me and asked me if I could have someone from SEITT bring a specimen! If that had happened, this particular situation would not have occurred.

In an interview after this workshop, Batsirai indicated that during this talk on *Quelea* he felt like a teacher because his students would make the exact same mistake. Batsirai said that this helped him realize how much teachers are like students in their learning. He said:

There was that confusion about the Shona names and English names and when I chipped in and said, "When you are doing this with the students you need to be very careful because some of the names could be of the same organism." Now I really felt like I was more of a teacher of the students because I often find that type of problem with students. I didn't expect it from teachers (int-2, August 1997).

Leading the workshop put him in the position in which he began to think about some of the problems his colleagues have around science. Batsirai indicated that SEITT has helped him learn more about teachers as learners. He found that teachers and students make the same mistakes:

I think you remember when we were writing the names of birds [We wrote *Quelea* in English and also in Shona as separate birds]. So even the students do that. So for me it is an eye opener because we won't look at students as different human beings because if students are making the same mistakes as teachers. I think, we, as teachers, tend to say students fail because of this, they are like this, they are like that, not knowing that we are like them ourselves. Given the same problem we make the same mistakes (int-2, August 1997).

Batsirai made connections between errors made by students and teachers. He realized that mistakes in biology were not limited to students. Teachers might make the same mistakes. Batsirai became aware of this

similarity of students and teachers through facilitating a workshop. He was in a context that Loucks-Horsley et al. (1998) suggest is necessary for effective professional developmental experiences. That is, "Effective professional development experiences use or model with teachers the strategies teachers will use with their students" (p. 35). By facilitating this workshop, Batsirai came to understand that teachers and students made the same mistakes as learners.

However, at this time Batsirai did not see these common mistakes as opportunities to probe teachers as he might probe students. He suggested that he was put into the position of a teacher by the presentation of the English and Shona names and he did not like it:

What I did there is exactly what I do ... that is exactly the way I talk with students. Only in the workshop, I said this can also happen with your own students. I think they put me in a tight corner. I felt I was more of a teacher than a colleague.

Batsirai expressed his concern about being put in a corner. There was a misunderstanding and he needed to respond to it. Though he turned around the mistake and suggested it is something they, as teachers, need to consider when teaching their own students, he was still uncomfortable and wanted to avoid this type of problem. He did not want to take the role of teacher with the teachers. His conception of his new role of resource teacher did not seem to include examining each other's beliefs about biology. When he was put in that position, he avoided it by getting out of his corner.

Batsirai's Role in Teacher Education

Though Batsirai had become aware of mistakes that teachers make, he did not seem to believe that this type of issue would be the substance of working with teachers. He seemed to conceive of the new resource teacher as a provider of materials and organizer of workshops.

At the end of the workshop in his region, Batsirai presented some sources of materials that teachers could use. Batsirai said, "We will give you some materials. Here at the SMC we have a book of materials for you to use. Also we have some marking schemes for the June 1995 examination. Over lunch we can talk about texts."

As the teachers were looking at some texts that Batsirai had brought, one participant asked, "Can we have certain publications on options?" and Batsirai responded, "At my school we have these books from Cambridge, a series of 10. They are very useful with excellent photos." Batsirai showed the books that he had brought. Another participant asked, "Can you get subscription to New Scientist?" Batsirai indicated that he could bring up the topic at the SMC's management committee. More teachers came up front and they all started sharing ideas about books to use as resources, magazines to order, and kits to use in the classroom. The participants went as a group to lunch and talked about how the workshop had created a unique opportunity to share ideas about resources. These teachers talked about how they might use the case study in their classes. To Batsirai, one role of being a resource teacher meant literally a resource person, one who identified resources for other teachers.

In addition to being a resource person, Batsirai suggested the new role involved organizing workshops so teachers can share ideas:

If all goes well, I think I would like to be involved more in the organization of these workshops so that we have teachers together where they come and discuss the issues which are pertinent to the teaching of the subject. Having more workshops and organizing more workshops so that we can help each other with the subject teachers in other schools. I think that would be one of my aims (int-2, August 1997).

This interview was five months before the end of his studies in the project. He had had many opportunities to work as a resource teacher. He had surveyed A-level biology teachers in his region, interviewed education administrators, worked with other resource teachers and education administrators in setting up the SMC at a regional school, and carried out a workshop.

Now he was looking toward a role of organizing workshops to bring teachers together to learn and share. His role would be that of a workshop facilitator. He would facilitate the meetings of teachers and their discussions. This role does not seem to include examining teachers' thinking and conceptions of biology. His concerns were with nurturing relationships and not colleagues' conceptions of biology and learning.

Teacher Education: Nurture Versus Conflict

Batsirai indicated that one reason he decided to participate in the SEITT project was to work with colleagues. Batsirai talked about his own learning and how doing and talking were important. Both in his schooling in Zimbabwe and in the matriculation year in Australia, Batsirai talked about how his learning was social. Batsirai was interested in working with teachers, but he found it involved

tension. His concerns had less to do with the content and structure of the workshops and more with the relationships with teachers and administrators.

Batsirai mentioned these concerns when he talked about the differences between working with peers and with students:

I think it is dealing with peers at a workshop, people who are your equals and what not and you have to be more careful of what you say and do. With the students, they are at a certain level and you have to guide them a lot. With the adults at a workshop, they need to be left alone to do things and pay attention to what they are doing. I think the students need to find out if they are doing what is expected, whereas with the adults you assume that they know how it is supposed to be done. The approach is almost the same in terms of coverage of the material, like the types of activities and what not. You can do the same at the workshop and do the same thing in class. I think the only difference is in the way or the role of the resource teacher or the role of the teacher in the class has to change a bit (int-1, June 1997).

Batsirai realized that the role of the resource teacher and teacher had to change even though the content might be the same. Teachers have to be left alone. Yet he also talked about the need to foster a relationship with colleagues over time, in order to avoid conflict:

You need to inculcate that relationship slowly. You need to take calculations so that you end up with a positive relationship and not a negative one because sometimes if you start with a bang, then the other person might think you are being showy. So I think if you do it slowly, I mean slowly find out what they like and don't like, so that you can work properly together (int-2, August 1997).

He spoke of nurturing a relationship. He planned on working with these teachers for many years and did not want to appear "showy". Whereas Rumbi talked about "not being a dictator" with teachers, Batsirai's actions in the workshop meshed quite closely with his words. He was much more cautious. He

did not provide answers or push the participants to move along. He left them alone, so to speak. In fact, his own workshop ended without closure.

Batsirai's concerns encompassed two aspects: conflict and nurturing. Conflict is a common barrier mentioned in the literature. Little (1990b) discusses the risk of conflict as a high transaction cost. Bird (1986) alludes to conflict when he talk about mentors and their dilemma. He says of mentors, "If they assert themselves too strongly, they will be rude or disruptive. If they assert themselves too little or unskillfully, they will be useless" (p. 8).

The nurturing component is less often discussed in relation to the conflict. Feiman-Nemser and Parker (1992) seem to refer to these together when they talk about how mentors need to be agents of change rather than just local guides and educational companions. As agents of change, the mentors can help foster norms of collaboration and inquiry. However, Batsirai seemed more concerned with how to nurture teachers in an educational context, where peers have not been critical of each other's ideas and where his role was also new in the system.

This nurturing is not limited to the sense of caring for each other in an emotional and supportive sense (Noddings, 1984). Rather, Batsirai's idea of nurturing involved building mutual trust so that an environment could be constructed in which teachers can exchange ideas. He saw the construction of this environment as a precursor to working with colleagues. In his classes, he constructed such an environment, yet he encouraged divergent views. With teachers, though, it appeared he found it much more difficult to construct this environment.

This concern for potential conflict also arose when Batsirai talked about working at the centers. He was worried that the host school of the SMC might not continue to welcome the resource teachers. The staff at the host school might see the resource teachers as an “inconvenience” since the resource teachers will need to go in to the office to get keys whenever they go to the SMC. This is a type of administrative control that was feared. Batsirai said:

At the moment, what we are worried about is the resource teacher and the host school. Are these people going to continue to welcome us the way they are doing or are things going to change? And if there are changes, what will happen. Now, it is OK. We are not making a lot of visits. Going once per month or five times per month people might think, “Ah, you are bothering me” (int-3, September 1997).

Batsirai wanted to work with teachers in the SMC, but he had concerns around relationships and maintaining them. These include relationships with the teachers he will be sharing with as well as the staff at the school where the SMC is located. Batsirai's concerns revolved around communication with different actors. While SEITT did mention these different actors, Batsirai's specific concerns about building relationships were not a main part of the SEITT project.

Summary

Batsirai engaged in teaching that drew on students' ideas and also helped the students prepare for the examinations. Many aspects of his teaching seemed to arise from his own past experiences. He had opportunities in secondary school to make charts and make equipment. In Australia, he was involved with a new way of studying that required the student to study and check learning with the teacher. Batsirai also suggested that he learned best by doing and talking. In his

own classroom, this was the way he taught. Batsirai's ways of teaching fit closely with the ideas espoused by SEITT and Batsirai refined his practice through participating in the project.

However, his background, his use of student-centered ideas in his class, and his wish to work with other teachers did not prepare him to work similarly with teachers. He could organize workshops, but he was not sure how to nurture relationships with teachers or to handle tensions. He wanted relationships but he did not want tensions. Thus, though Batsirai was an effective teacher using student-centered learning as espoused by the project, this did not necessarily prepare him for the new role of resource teacher and working with colleagues.

CHAPTER 7 CONCLUSION: INTERACTION BETWEEN TEACHER AND OPPORTUNITY

The SEITT project was initiated due to the Ministry of Education's perceived need to improve teaching and learning of A-level science and mathematics in Zimbabwe. The project aimed to provide a group of experienced teachers with new ideas and instructional strategies and to prepare them to help other teachers improve their practice through workshops and support at centers. Thus, changing current practice and introducing a new leadership that involved different collegial relationships were part of the model.

While this research was not initiated in order to evaluate the SEITT project, in a sense, it does examine how these teachers perceive the project's influence on them as teachers and leaders. This last chapter starts with a summary of the cases of the three teachers and then examines their learning in terms of their classroom teaching and of their new roles as teacher educators. It then considers how these teachers and their learning fit with literature on professional development. I end by considering implications of this research.

Three Resource Teachers

Rumbi, Tendai and Batsirai participated in the SEITT project for two years. They did not enter with the same purposes, skills and beliefs and they did not leave having gained the same skills and beliefs. While all three teachers did gain knowledge and experience with organizing and carrying out a workshop, the influence on each teacher's classroom practice differed.

Rumbi is portrayed here as caught between the old and the new. This metaphor of caught between also suggests that she was moving between these two points in both her teaching and her new leadership role. Rumbi's beliefs about organizing learning were changing. Before taking part in SEITT, Rumbi indicated that she had lectured a great deal. While participating in SEITT, she felt that it was important for learners to be active. She put students in groups so that they could exchange ideas. However, she still focused on the examination and syllabus and felt her role was to provide the facts to the students. In the end, Rumbi had the answers. As a resource teacher, she encouraged teachers to work in groups and exchange ideas. For her, the resource teacher's facilitating role revolved around providing a context for the exchange of ideas, but the role did not include thinking about these ideas were linked to student learning.

Tendai, on the other hand, changed his teaching very little. He decided to participate in SEITT in order to get out of teaching. His teaching in the classroom did not change; he continued to focus on the examination. His beliefs about the purpose of teaching and learning remained relatively unchanged. At the workshops, he seemed to focus on skills that he saw as necessary for a particular role as a teacher educator. He did organize the learning environment to include group work, but he seemed to push the teachers to finish the discussions in order to get to the feedback sections. A discussion was a means to an end, just as going over tests in classes was a means for telling the students what they needed to know.

In his work with SEITT, Batsirai was refining his teaching practice while developing new conceptions about working with colleagues. As a youth, he had been involved in his own learning with teachers who seemed student-centered. For Batsirai, his matriculation year in Australia, in which he took responsibility for his learning, remains a powerful influence on his teaching. Hence, before SEITT he was already incorporating constructivist practices in his classroom teaching and was finding ways to improve the learning of his students. As a resource teacher, like Rumbi and Tendai, he accomplished organizing a workshop in which teachers discussed and exchanged ideas. He gained the procedural skills for this. He also began to notice complexities inherent in working with teachers, but he had little opportunity to explore approaches to them.

By examining these three teachers together, we can learn about the interaction between teachers and a professional development opportunity. Specifically, what did each teacher seem to gain in terms of classroom teaching and in the new role as teacher educator?

Teaching

The links between classroom practice and the professional development opportunities differed for these teachers. I examined Tendai, Rumbi and Batsirai using the Stages of Concern Model around student-centered learning (Hord et al., 1987, p. 31). Tendai seemed to remain at the PERSONAL level, with a concern that focused on how innovation might affect him in the classroom and his own career concerns. Rumbi was still concerned with the CONSEQUENCE and how her way of organizing learning might help the students, while Batsirai

was REFOCUSING and finding new ways to get the students involved. Tendai, who wanted out of teaching, took very little away from the project to help his classroom teaching. Batsirai and Rumbi suggested that they had improved their teaching because of participating in the project.

Tendai's beliefs and experiences in his own schooling limited rather than expanded his view of student learning. Tendai viewed students' abilities as fixed. He believed his role was less to help students with new opportunities of learning than to give them the facts they needed. His was a transmission model. Participating in the SEITT project did not greatly influence his teaching practice.

While Tendai made clear that he wanted out of teaching and was not interested in putting the time in to implement new ideas in the classroom, both Batsirai and Rumbi were trying to improve their teaching. However, they arrived at the project with different experiences in the classroom and different views of learning.

Of the three teachers, Rumbi had actually made the most drastic change due to her involvement in SEITT. Rumbi was thinking about how putting students together to generate answers in groups could help their learning. This grouping and generation of answers was Rumbi's way of implementing a student-centered learning classroom. Her conception, at this point, was limited to using various strategies that SEITT promoted and modeled. She taught as the SEITT staff modeled. In this sense, she changed a great deal. However, while she emphasized some parts of SEITT's issues, she did not refer to one of the central ideas of constructivism that SEITT promoted--students constructing their own

meanings. She did not reject the idea that students might construct their own meanings. Rather, she had not had the experiences of participating in this type of learning and, quite possibly, she did not know what it might look like. In addition, as a learner Rumbi valued tangible experiences and her lack of such experiences while participating in SEITT may have contributed to her limited implementation of a student-centered classroom.

On the other hand, Batsirai was helping students make sense of their own understandings. In his classroom, students discussed questions in groups, wrote their answers on the board and explored these student-generated ideas. Batsirai did not learn this at the project. He had been teaching this way for years. He seemed to have learned this type of teaching through early experiences in Zimbabwe and the matriculation year in Australia. His prior experiences and beliefs, developed at those periods, helped to shape his way of teaching and thinking about learning. For Batsirai, SEITT reinforced his prior beliefs, reaffirmed his approaches, and helped him refine his practice and thinking about student learning as the task/problem dichotomy suggests.

Tendai did not change his classroom practice, Rumbi was reshaping the organization of the classroom by incorporating group work, and Batsirai was fine-tuning his teaching. Rumbi, who was changing the most, was providing students the opportunity to talk, but the talk itself was not central to the learning in the classroom. Her reshaping was a technical, not substantive, change in the classroom. For all three teachers, as they learned to become teacher educators, this technical aspect of using new strategies also stands out.

Teacher Education: Technical Yet Discussion-Based

While Tendai, Rumbi and Batsirai responded differently in what they took away from the project in terms of their teaching, all three of the teachers learned the technical aspects of carrying out a workshop. Before participating in SEITT, these resource teachers did not clearly understand what their roles would be as resource teachers. Running a workshop using active learning strategies was not what they mentioned as an expectation. Yet, this is one role that all three were able to carry out in their regions. In the third residential period, they helped put together a workshop, practiced it, reflected on how to improve the strategies and use of time, and revised the workshop activity sheets. Then they carried out workshops in their regions that drew on what they had practiced in the third residential period.

The workshops in the regions were more interactive than workshops the teachers were used to. The teachers worked in groups, generated ideas and listed these ideas. However, in order to carry out the workshops, the resource teachers could rely a great deal on the activity sheets that they developed at the third residential period. In this format, the resource teachers did not necessarily have to think about what learning was being promoted. Though the resource teachers did reflect on using strategies and how to make them fit with the context of workshops, the resource teachers never reflected on their own frames of thinking about learning and how these might influence others' learning. The resource teachers did not probe their beliefs about teaching and learning and how SEITT's ideas fit with their own beliefs. The reflection was limited to the

technical concerns of using a strategy with groups and this reflection did not seem to extend to considering how to work with peers and their ideas.

Teacher Education: Relationships with Peers

All three resource teachers had a common concern about their work as teacher educators--they were worried about relationships with other resource teachers and A-level biology teachers. They wanted to avoid instances of conflict. However, the specific focus of this concern varied. Rumbi did not want to be a dictator; Tendai felt he might not have adequate subject matter knowledge; and Batsirai had a dilemma around nurturing and avoiding conflict with other teachers.

Rumbi talked about how she did not want to be a "dictator" with teachers or students and wanted to incorporate active learning activities in both the classroom and workshops. However, Rumbi said that when working with adults, "...you treat them with respect" (int-1, July 1997). She added that teachers are older than students and hold more education. Rumbi's discussion about the differences between working with teachers and students revolved not around learning, but around relationships--peer relations, on the one hand, and teacher-student roles on the other. In the teacher-student dichotomy, Rumbi assumed a relationship in which she possessed the relevant knowledge that she was to pass on to the students. Hence, she did not hesitate to correct students' mistakes. The relationship between teachers, on the other hand, involved respect, and a facilitator of teacher learning needed a cautionary stance so as not to embarrass

teachers. Thus, Rumbi was concerned with how to approach mistakes of teachers while maintaining respect between colleagues.

Tendai was concerned about his possible lack of subject matter knowledge when comparing himself to his colleagues. He was worried that teachers might think that he did not have enough subject matter knowledge to be a facilitator of other teachers. He seemed to be less concerned with how to respond to teachers than with how his legitimacy as a teacher leader could be maintained.

Batsirai's concern was around nurturing relationships, learning about teachers, and avoiding conflict. He wanted to provide an environment in which teachers could share ideas. He felt that it would take time to build this nurturing relationship. Batsirai also began to learn more about teachers and their understandings of biology. In the workshop he carried out, he discovered that teachers made the same types of mistakes as students. Indeed, he expressed surprise when he noted that the teachers in the workshop listed the Quelea bird both in English and Shona. However, he did not view these mistakes as his area of work as a resource teacher. Rather, like Rumbi, he wanted to avoid any type of conflict.

All three resource teachers learned some skills for carrying out a workshop and working with colleagues. However, they did not think about the practice of leadership. They simply wanted to avoid conflicts. Literature on teachers working together suggests that some conflict is needed to help teachers change their practice. Little talks about the need for "informed dissent" (1993, p.

138) and the need to examine alternatives as well as underlying assumptions.

Lord (1994) calls this critical colleagueship. He elaborates:

...collegiality will need to support a critical stance toward teaching. This means more than simply sharing ideas or supporting one's colleagues in the change process. It means confronting traditional practice--the teacher's own and that of his or here colleagues--with an eye toward wholesale revision (p. 192).

However, with the content of the SEITT project focusing on learning strategies, this critical stance was not a part of the content of the project. The teachers did develop a critical gaze about their use of strategies, and in the residential period, provided ideas on how to improve the strategies. However, this critical reflection did not extend to confronting their beliefs about teaching or their colleagues' beliefs.

The resource teachers were not provided opportunities to think about and engage in learning in which some conflict could lead to deeper learning. They did not examine their own beliefs about learning. It might be countered that the resource teachers only had one or two opportunities to engage with teachers in half-day workshops, and, thus, would not have had time to build relationships in which conflict might be accepted. While that is true, it is also apparent that in the residential periods of professional preparation as teacher leaders, the resource teachers did not have opportunities to think about and to engage in critical colleagueship. Without at least some opportunities to examine each others' ideas about learning and teaching, it is very unlikely that such critical peer engagement will suddenly spring up in group work led by newly trained resource teachers. If

the resource teachers were not provided opportunities to learn to lead, they will not know how to lead.

If the work of the resource teachers is to help other teachers change both their strategies and their ways of thinking about teaching, then these teachers also need to be part of a conversation on the role of resource teachers. Since these conversations did not go on, the role of resource teacher remained a technical role for all concerned. If the role of resource teacher as both technician and cognitive guide had been explicitly discussed and experimented with in the residential periods, the three teachers might have begun to develop perspectives that drew on teachers' beliefs and experiences. This would have made what Tendai, Rumbi and Batsirai brought to the SEITT project more central to the learning and the resource teachers might not have focused just on acquiring new strategies that had been developed elsewhere.

Tendai, Rumbi, Batsirai and Professional Development

What can the experiences of three teachers participating in a professional development offer teachers elsewhere? This study reinforces several views of professional development projects. It argues that teachers participate in professional development projects for their own reasons and that the beliefs and experiences that teachers bring to a project are a key element influencing what participants may learn. This study points out that teachers do not arrive at professional development opportunities with similar needs, experiences, beliefs, and skills. It seems particularly significant that the teachers did not decide to attend the professional opportunity in order to analyze their beliefs. Rather, more

often teachers attend professional development opportunities in order to learn new instructional strategies (Wilson and Berne, 1999). These Zimbabwe resource teachers and the teachers at the workshops were no different. They came to learn about strategies and possibly subject matter; reflecting on their own beliefs, experiences and knowledge was not a main reason for participating.

Borko and Putnam's (1995) warning about the tendency to underestimate the need to focus on how teachers' beliefs and knowledge interact with new ideas is also important to those planning professional development projects:

Furthermore, teachers' knowledge and beliefs cannot be circumvented by efforts to reform educational practice. Teaching for understanding, because it requires thoughtful interaction with students around important ideas, is especially dependent on teachers' knowledge and beliefs. Efforts to develop programmed instruction or "teacher-proof" curricula notwithstanding, thoughtful teaching cannot be completely predetermined or scripted (p. 60).

SEITT's model was not unlike a "teacher-proof" model in the West that focuses on teaching strategies and subject matter. It appears that the same criticism could be leveled at SEITT as is leveled at those programs: it does not change the way teachers think about student learning.

The experiences of Rumbi, Tendai, and Batsirai highlight the need for professional development experiences to go beyond the level of strategies. This is especially true when the learner, an experienced teacher, comes to the professional development opportunity with prior experiences and deeply held and unexamined beliefs. These aspects of each learner interact in their own way with the professional development experience. There is not one way of interacting. If professional development experiences leave these beliefs and experiences of

the learners unexamined, the opportunities run the risk of adding on to what teachers are doing without really changing how the experienced teachers think about, and hence engage in, teaching and learning.

Implications

This study was about teacher learning in a professional development project in a country that has problems because of the distances between schools, transportation, and limited resources. While the study only examined the experiences of three participants, the results do help us think about how opportunities need to draw on, rather than downplay, teachers' beliefs and experiences. If teachers' beliefs about learning and students and their own experiences are left unexamined, how can teachers become aware of a need to change? For example, Rumbi seemed to believe that group work would involve the students more and get them thinking; however, she still believed that she needed to give them the answers. Her views on knowledge were left relatively unexamined. Alone, she will not reflect on those conceptions. Rumbi, and teachers like her, need long-term collaborative opportunities with other teachers and someone who can guide them to bring these beliefs and experiences into the topic of discussion.

Project organizers need to think about shifting focus from strategies toward student learning. This would not mean ignoring strategies and subject matter. Rather it would mean respecting and discussing the teachers' own beliefs and knowledge and examining strategies and knowledge from their perspectives. This would mean that teachers would have to have ongoing opportunities to

interact with other teachers. In this approach, the SMCs could become the locations for continued study of teachers' own concepts of learning and how they influence student learning. With someone to guide the teachers and with images of teaching, such as videos of Batsirai's teaching, this could occur.

This brings us to a possible barrier that these three teachers faced—their assumptions about relationships with peers. The teachers' views about these relationships, like the teachers' thinking, need to shift from a fear of conflict towards an orientation that considers how they can assist each towards the goal of improving student learning. It might be argued that because Zimbabwe is a society in which hierarchical arrangements grant more authority for knowledge to some than others based on one's social status, teachers might not accept a view that involves being critical colleagues. While some teachers might grapple with this new role of teacher, a new view might also emerge if teachers discuss what this new role encompasses and if they then develop the nurturing conditions that Batsirai seemed to be considering.

Though this research explicitly did not aim at evaluating the SEITT project, some of the implications do, in fact, address the form and content of the project. The overall structure of SEITT seemed to promote a sustainable environment for the project. In a country with limited resources, the systematic approach embedded the project into the educational system. The project staff were part of the University of Zimbabwe, the resource teachers were practicing A-level teachers and the SMCs were established in A-level schools.

Within this structure, the project introduced teachers to new instructional strategies so that they became aware of alternatives. However, the focus on instructional strategies, to the relative exclusion of considering teachers' beliefs and experiences supported a view of teachers as technicians. One reason for this result may have been the narrowness of definitions of words. For example, while student-centered learning was discussed in a multifaceted way, including students constructing their knowledge, the teachers never had opportunities to work with this idea in the same way as they did with strategies. In SEITT, the participants assumed that they all had the same understandings of these terms, but this was not true. For example, Rumbi thought that "student-centered" meant letting students generate ideas in groups while Batsirai viewed "student-centered" as generating and using those ideas to probe students' thinking. The project's external consultant viewed "student-centered" as an approach in which a teacher made use of a variety of strategies. Similarly, though they discussed "reflecting on learning", in the project this meant reflecting on how strategies worked and on the structure of the workshops. Reflection on how students learned through these new strategies seemed peripheral. These key words needed to be mutually understood by all participants, including the staff, resource teachers, teachers and students. The participants also needed opportunities to put these concepts into practice. As they practiced using strategies, they needed to practice reflecting on learning.

Programs need to consider the beliefs and past experiences of teachers and project staff. Beliefs and remembrances of past experiences should be part

of the content of the professional development opportunity. The participants need to do more than share ideas; they need opportunities to confront their own practices with the aim towards improving them. This will not involve avoiding conflicts in views on learning, but opportunities to discuss these views and why teachers hold them.

A caveat, however, is necessary. Many projects start from the premise that if teachers understand the theory behind new strategies, they will change practice (Ball, 1989; Guskey, 1989; Guskey & Huberman, 1995). While addressing beliefs is important, it should be only a part of the content. We need to keep in mind Guskey's argument that changes in teaching often precede changes in beliefs (Guskey, 1989). I am not suggesting that professional development opportunities should focus entirely on changing teachers' beliefs through presenting theory. Rather the beliefs that teachers bring to learning opportunities need to be an explicit aspect of teachers' learning in professional development opportunities. If beliefs are ignored, strategies learned may be activities that promote interaction but not learning.

This research has closely examined three teachers participating in a professional development project that aimed to change their teaching practice and help them become teacher leaders. While change occurred, I have argued that the change was more technical than conceptual. If the types of changes that a project seek are student-centered ones that draw on and use learners' ideas and thinking to help them grow, then the teachers need to experience this type of learning themselves. In the interaction between the learner and the opportunity,

this makes the learner's tacit beliefs and experiences key components in the professional development opportunity.

This suggests that professional development opportunities need to consider what teachers bring to a project in terms of beliefs and experiences alongside what the project aims to accomplish. The content and form of the project need to be organized around these key aspects.

Since teachers often are not used to examining their beliefs and experiences and how they shape what they do, this aspect of a professional development project must be made explicit and pursued in both theory and action. Richardson (1990) calls this empowering teachers, which is what professional development is often about:

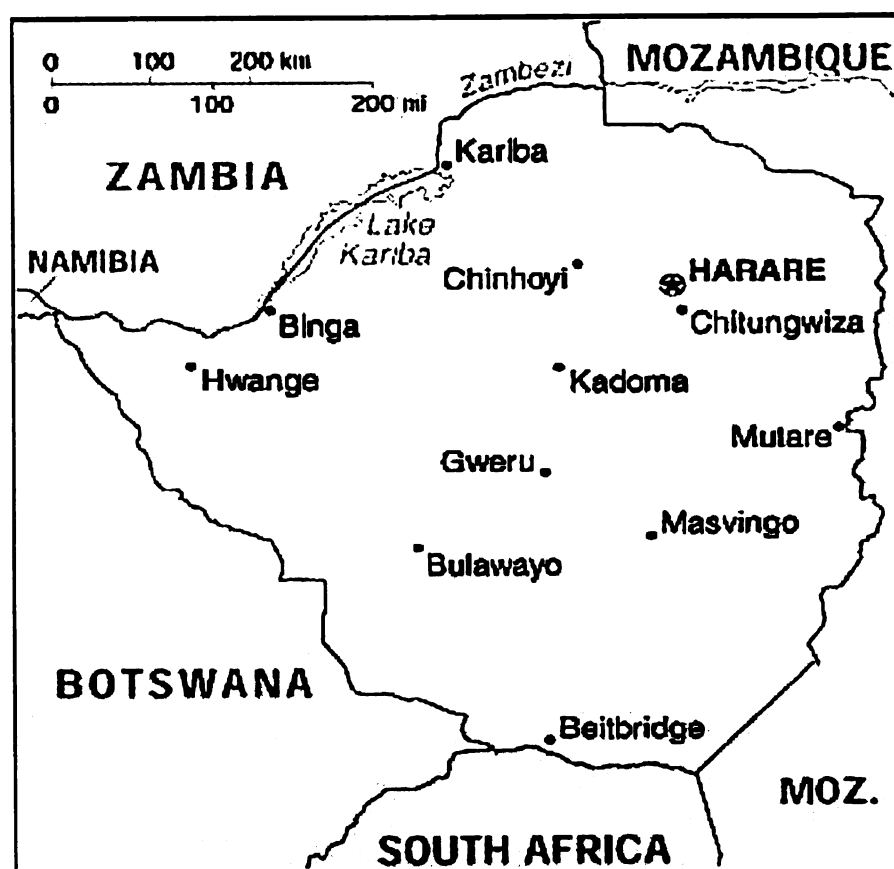
Empowerment is threatened when teachers are asked to make changes in activities without being asked to examine their theoretical frameworks. In fact, teacher empowerment does not occur without reflection and the development of the means to express justifications. Without such empowerment, teachers may become victims of their personal biographies, systemic political demands, and ecological conditions, rather than making use of them in developing and sustaining worthwhile and significant change (p. 16).

This empowerment, as I have suggested, is not just limited to the individual. I have argued for both a personal as well as a socially constructed type of empowerment. While teachers do come with their own beliefs and experiences that shape what they learn, it is the interaction with the professional development opportunity and the people in it that shapes what a teacher learns. Teachers all come with tacit beliefs about what professional development encompasses as well as what key words, such as constructivism, mean. These

beliefs need to be discussed and then learners need to engage in activities to understand what putting ideas into practice involves and how colleagues can help as all participants learn.

APPENDICES

APPENDIX A
ZIMBABWE MAP



From <http://www.cia.gov/cia/publications/factbook/figures/zi-map.jpg>

APPENDIX B

TIME LINE FOR RESEARCH

Year	SEITT	Resource Teachers	Scott
1995			5/95 visit Zimbabwe
	9/95 initial workshops		
1996		3/96 residential period 1 assignment: needs analysis	
		8/96 residential period 2 assignment: establish management committees, workshop to introduce SEITT	
		10/96 examination	
1997			1/97 arrive Zimbabwe
	2-3/97 support visits to regions		2-3/support visits to regions
		3/97 introductory workshop	Attend workshop
		4/97 residential period 3 assignment: workshop	Attend residential period
			Begin interviews and observations in 2 regions
		5/27 region 2 meeting	Attend
		6/13 region 2 meetings	Attend
	June and July visit regional workshops		
		6/7 workshop region 1	Attend workshop
		6/19 region 2 meeting	Attend
		6/20 workshop region 2	Attend workshop
		7/5 2 nd workshop region 1	Attend workshop
		8/97 residential period 4 assignment: individual research paper	Attend residential period
			Sept. and October: Final interviews
			Give cases to RTs
			Leave Nov. 17

OBSERVATION AND INTERVIEWS

Batsirai	Cephas	Kedmon	Rumbi	Ngoni	Tendai
			2/04 ob-1; talk 2/05 ob-2 practical)		
			4/1 ob-3; talk		
	5/21 int-1	5/21 int-1 5/27 ob-1 5/28 ob-2			
		5/30 ob-3; int-2			
6/25 ob-1 6/2 6 ob-2 6/27 ob-3; int-1	6/2 ob-1 6/3 ob-2 6/4 ob-3 6/6 ob-4; int-2			6/16 ob-1 6/17 ob-2 6/19 ob-3; int-1	
		7/29 int-3	7/28 ob-4 7/29 ob-5; int-1		7/8 ob-1 7/11 ob-2; int-1
8/1 ob-4; int-2	8/14 int-3			8/1 int-2	
9/18 int-3		9/23 int-4		9/18 int-3	9/26 int-2
10/26 mail case	10/13 ob-5; int-4 10/26 give case	10/26- give case	10/15 int-2 10/26 give case	10/26 mail case	10/26 mail case

APPENDIX C

QUESTIONNAIRE FOR SEITT RESOURCE TEACHERS

My name is Scott Johnston and I am a doctoral student in the Department of Education at Michigan State University in the United States. I am interested in learning more about the process, by which you learn to become resource teachers, and how you carry out the work at Science and Mathematics Centres. The purpose of this questionnaire is to understand your ideas about science and mathematics education, and the possible responsibilities as resource teachers in Zimbabwe. There are no right or wrong responses as far as this study is concerned.

All responses are confidential. No references to individuals or their schools will be reported in the final study. Completed questionnaires will not be available for review by officials of your school or the Ministry of Education. It is necessary to provide your name and that of your school for purposes of conducting interviews with some of the respondents of the questionnaire. You indicate your voluntary agreement to participate by completing and returning this questionnaire.

PART I. SCIENCE/MATHEMATICS EDUCATION

Directions: Read the following statements and circle one of the numbers that indicates the relationship of the statement to your feelings about the subject you teach and its instruction.

Select ONE best answer that reflects the strength of agreement (SA) or disagreement (SD).

1 2 3 4 5
SA SD

1=strongly agree 2=agree 3=not sure 4=disagree 5=strongly disagree

1. Using past exam questions is the best way to ensure that students are effectively prepared for their final examinations.

1 2 3 4 5
SA SD

2. Z.J.C. and O-Level examinations do a good job of testing valuable knowledge and skills needed to study at the A-Level.

1 2 3 4 5
SA SD

3. Tests provide a good measure of how well students understand the scientific concepts in the text.

1 2 3 4 5
SA SD

4. Science syllabi provide adequate guidance on the goals of what should be covered at any given level.

1 2 3 4 5
SA SD

5. When students work in small groups they often make mistakes which make group work less effective.

1 2 3 4 5
SA SD

6. If students get into arguments about ideas or procedures in class, it can impede their learning of mathematics or science.

1 2 3 4 5
SA SD

7. Students must master topics and skills at one level before going on.

1 2 3 4 5
SA SD

8. Since older students can reason abstractly, the use of models and other visual aids becomes less necessary.

1 2 3 4 5
SA SD

9. Teachers who have taught over ten years will not find the workshops and Centres helpful.

1 2 3 4 5
SA SD

10. Teachers whose students do well on A-level examinations will not need more professional development.

1 2 3 4 5
SA SD

For the following two questions, read the information on four teachers, choose one answer and circle that number.

Four teachers-Chipo, Grace, Tawanda, and Albert-describe their roles as teachers in helping their students learn.

Chipo: "I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover concepts for themselves."

Grace: "I think I need to provide more guidance than that. I try to lead my students to figure things out by asking pointed questions that I hope will get them to the answer without telling them."

Tawanda: "I emphasize group discussion in my classroom. We talk about concepts and problems together, exploring the meaning and evaluating the reasoning that underlies different strategies. My role is to initiate and guide these discussions."

Albert: "That's all nice, but students really won't learn the material unless you go over the material in a detailed and structured way. I think it's my job to explain, to show students how to do the work, and to give them practice doing it."

11. Which teacher is most likely to be successful in helping students learn?
(Circle one.)

1. Chipu 2. Grace 3. Tawanda 4. Albert

12. Which teacher is least likely to be successful in helping students learn?
(Circle one.)

1. Chipu 2. Grace 3. Tawanda 4. Albert

For the following two questions, prioritize the lists from one to six with one indicating the most frequent source.

13. When students are successful in achieving intended goals or objectives, that success is often attributed to one of the following sources. Prioritize the list with (1) indicating the most frequent source of success.

- ____ 1. Student's home background
____ 2. Student's intellectual ability
____ 3. Student's enthusiasm or perseverance
____ 4. Teacher's attention to the unique interests and abilities of students
____ 5. Teacher's use of effective methods of teaching
____ 6. Teacher's enthusiasm or perseverance

14. When students fail to achieve intended goals or objectives, that failure is often attributed to one of the following sources. Prioritize the list with (1) indicating the most frequent source of failure.

- ____ 1. Student's home background
____ 2. Student's intellectual ability
____ 3. Student's indifference or lack of perseverance
____ 4. Teacher's failure to consider the unique interests and abilities of students
____ 5. Teacher's failure to use effective methods of teaching
____ 6. Teacher's indifference or lack of perseverance

PART II. SEITT AND RESOURCE TEACHERS

Directions: Read the following statements and circle one of the numbers that indicates the relationship of the statement to your feelings about the subject you teach and its instruction.

Select ONE best answer that reflects the strength of agreement (SA) or disagreement (SD).

1 2 3 4 5
SA SD

1=strongly agree 2=agree 3=not sure 4=disagree 5=strongly disagree

15. The head of my school is supportive of my participation in SEITT.

1 2 3 4 5
SA SD

16. In residential period two, having other resource teachers observe me teach and provide feedback was helpful.

1 2 3 4 5
SA SD

17. This type of peer observation will be difficult to implement as a resource teacher.

1 2 3 4 5
SA SD

18. Which of the following factors do you believe will be most useful in working with other resource teachers? (*Circle one.*)

1. my deep knowledge of subject matter
2. my years of teaching experience
3. my ability to communicate clearly
4. the reputation of my school

19. Which of the following factors do you believe will be most useful in working with other A-level teachers? (*Circle one.*)

1. my deep knowledge of subject matter
2. my years of teaching experience
3. my ability to communicate clearly
4. the reputation of my school

20. Which do you believe will be the most important factor in determining the success of the centre? (*Circle one.*)

1. amount of resources in the center
2. support of administration
3. work of management committee
4. commitment of resource teachers
5. quality of workshops

21. In five years from now, what position would you like to hold? (*Circle as many as appropriate.*)

1. A-level teacher
2. head of department
3. head of school
4. lecturer at teacher college
5. university lecturer
6. Ministry of Education position, i.e., EO or RD
7. Other (please specify)_____

PART III. REFLECTIONS AS A RESOURCE TEACHER

Please answer the following questions in the space provided.

22. Why did you decide to become a resource teacher?

23. What are some of your concerns about this new responsibility as resource teacher?

24. How do you think the training and new responsibilities at the Science and Mathematics Centers will affect your present relationships with your colleagues at your school?

PART IV. CONTEXTUAL AND PERSONAL BACKGROUND

A. CONTEXTUAL BACKGROUND

1. Name:

2. Name of School:

3. School location:

Rural____ Urban:

4. Responsible Authority administering School:

Government____ Church____ District Council_____

Private Foundation____ Other (*specify*)_____

5. Reg

B. PE

6. G

7. A

2

3

4

5

8.

9.

10

5. Region of the school:

Harare_____	Mashonaland East_____
Masvingo_____	Mashonaland Central_____
Midlands_____	Mashonaland West _____
Manicaland_____	Matebeleland North _____
Matebeleland South _____	

B. PERSONAL BACKGROUND

6. Gender: M____ F_____

7. Age:

20-25 years_____	26-30 years_____
31-35 years_____	36-40 years_____
41-45 years_____	46-50 years _____
Above 51 years_____	

8. Subjects teaching at A-level: biology _____ chemistry _____ mathematics _____ physics _____

9. Highest qualifications:

B.Sc. _____ B.Ed. _____ Grad. C.E. _____ Licentiate _____ Other _____

10. A-Level science teaching experience:

1-5 years _____ 6-10 years _____ Over 11 years _____

Thank you very much for your cooperation.

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APPENDIX D

INTERVIEWS WITH TEACHERS²²

INTERVIEW 1

*Interview with file name:
*Place Date 21 May 1997
*interview # for this teacher time: begin end total time:
*day of computer input
*keywords:
[The * mark is needed for NUD*IST formatting]

*I. physical description of place:

*II. Questions

*Q.1: What do you mean by the answer to question 13 answer 4, teacher's attention to the unique interests and abilities of students?

*Q.2: You said that sciences are most difficult at this school. so why don't students study something like English, which is perceived easier?

*Q.3: I am wondering what you felt the difference was between answer 4 and 5 for questions 13 and 14. The question asked about source of success and failure of students. Number four says, teacher's attention to the unique interests and abilities of students and number five says, teacher's use of effective methods of teaching.

*Q.4: What do you mean by intellectual ability in answer 2?

*Q.5: For question 14, the source of students' failure, you chose student enthusiasm and perseverance. Why is that?

*Q.6: I don't see how enthusiasm fits in?

*Q.7: What do you mean by failure?

*Q.8: What is the best way to test this understanding?

²² These are examples of protocols that I used for the interviews. I used this as a framework and did not necessarily try to have all the questions answered. I encouraged the teachers to provide examples and to discuss ideas they felt were important. The interviews also included specific questions for teachers. For example, in Interview One I ask about specific responses on the survey and in Interview Two I ask questions about my observations in the classroom. Only in Interview Four did I try to ask all the same questions.

INTERVIEW 2²³

*Interview with _____ file name:
*Place _____ Date: June 6, 1997
*interview # for this teacher _____ time: begin _____ end _____ total time:
*day of computer input _____
*keywords: _____

***II. Questions**

*Q.1: When students are not prepared at the beginning of class, you sometimes send them out to the hall until they are ready? Why and what impact?

*Q.2: On Monday, you gave the example of a brake in having students start with key issues. Do students have problem stating key issues? Why?

Q.3: Why do you mark papers that students are working on in class? What purpose?

*Q.4: Will you be going over this practicum again before October?

*Q.5: In the survey, you said past exams are not the best way to prepare students for exam.. What do you think is the best way?

*Q.6: You indicated one day that you observe other teachers teaching? Could you tell me more about this? What do you look for?

*Q.7: How has being a participant in SEITT helped you in your teaching? Interaction with other RTs?

*Q.8: What do you think you will be mostly involved in doing when the SMC open?

***General information**

1. How many students are in this school?
2. How old is the school?
3. What is pass rate at your school in chemistry?
4. How much cost to come here as student?
5. Where do students go after a-level?
6. Why did you become a teacher?

²³ For this interview, I added General information at the end of the interview to gain some information on each of the teachers. Not all teachers provided this information.

INTERVIEW 3

*Interview informal: File name:
*Place: Date:
*interview # for this teacher Time begin: end: TOTAL
*keywords:

*II. QUESTIONS

I will start with more questions concerning the survey I gave and questions regarding science education. Then I will ask about the workshop.

*Q.1: What do you mean by student success and student failure?

*Q.2: Questions 11 and 12 presented teachers and you had to chose which one was most likely to be successful in helping students learn and which one was least likely. Why did you choose Chipu, the facilitator- oriented teacher to be most successful? Why did you choose Albert as the teacher least likely to be successful in helping students learn? Could you tell me what their teaching looks like?

*Q.3: On question three, you indicated that tests do provide a good measure of how well students understand the scientific concepts in the text. Why is this? Do you know of other ways to measure this understanding?

*Q.4: Tell me more about why you joined the SEITT project?

*Q.5: How did you first hear about the SEITT project? How is it different than you had expected?

*Q. 6: What do you see as the role of the resource teacher from January?

*Q.7: Could you describe your image of an ideal resource teacher? **Could you give me a metaphor for a Rt. For example, fill in the blank. An RT is like because....**

*Q.8: You've heard the word 'collegiality' in the SEITT residential period. What is the closest Shona word you can associate with it? Could you tell me more about that word?

*Q.9: You have often heard about student centered activities in SEITT. Could you give me examples of some of these?

*Q.10: Some teachers have said that student centered learning goes contrary to Zimbabwe culture. For example, in the home the father is the source of information. How do you feel about this?

Questions from observations from the workshop:

*Q.1: What are your general comments on the workshops?

- *Q.2: How did you improve on the first workshop?**
- *Q.3: Did you notice differences in the teachers between the two workshops?**
- *Q.4: Is there anything you would do different next time?**
- *Q.5: How is doing a workshop similar to and different from teaching (facilitating) in your own class?**
- *Q.6: How are workshop participants and students similar and different?**

INTERVIEW 4

***Interview with:**

***file:**

***Place:** Date: October 13, 1997

***interview number:** Time: 115-200

***keywords:**

***SUMMARY of interview:**

***Q.1: When you think back to your own experience as a student in grade 1 through A-level, are there any events, situations, or people that stand out?**

***Q.2: When you think back to your own experience as a student in the university are there any events, situations, or people that stand out?**

***Q.3: Where have you taught before you came here? How is the teaching at the two schools similar and different? [probe: students, role of exam, type of teaching, peer pressure, HM pressure, parent pressure, type of school]**

***Q.4: Do you think your teaching has changed over the years? What influenced this change?**

***Q.5: Do you think that the A-level exam and the national syllabus limit your ways of teaching? If so, in what ways? If there were not A-level exam, how would teaching be different?**

***Q.6: How is the way you were taught in secondary school similar to or different than the way you were taught in the university or professional school?**

***Q.7: I am not familiar with the teaching and learning that goes on in [licentiate, Graduate certificate, teachers college, B.Ed., B.Sc.]. What were your most memorable experiences?**

***Q.8: Some literature suggests that teachers teach the way that they were taught when they were young students rather than how they learned to teach in professional school. How much and in what ways does the way you teach differ from the ways you have been taught?**

***Q.9: The last residential period is completed for the SEITT project. As you approach the time when you will earn your post graduate diploma and work in the centers, are there some things you would like to know about or be able to do better?**

***Q.9a: In the residential period, I heard some signs of resistance to changing ways of teaching and designing materials. RTs suggested pressure from**

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*Q.10
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headmasters, students, parents, teachers might prohibit moving away from traditional ways of teaching and use of the textbook. What do you think?

***Q.10: How effective do you think SEITT will be in reaching its goal of 'increasing quality of A-level science and mathematics education'? What are some of the problems you think SEITT will face, what is your sense of how well prepared the project is to solve these problems?**

APPENDIX E

OBSERVATION GUIDE²⁴

***RT**

***filename:**

***Place Date Grade**

***observation # for this teacher**

***time: begin end total time:**

***computer input date**

***keywords**

***SCHOOL CONTEXT**

***I. physical description (seating arrangements, walls)**

***II. students (number, gender, etc.)**

***III. narrative of field notes: choose a group to focus on and try for direct quotes.**

***IV. Summary**

***Observer's comments in interpretative narrative addressing following:**

- 1. agreement of observed with teacher's views**
- 2. advanced organizer: How did she plan to teach the class?**
- 3. classroom management: What is the approach and evidence?**
- 4. questions: What kind of questions are asked and what is the pattern?**
- 5. awareness of learners: How aware is the teacher of learners' strengths and weaknesses? How did the teacher find out what students knew?**
- 6. student errors: What type of errors were made? How did the teacher respond?**
- 7. student diversity: How did the teacher respond?**

²⁴ I took a sheet like this to each observation to remind me of my focus. The narration filled-up most of the fieldnotes. I tried to get as many quotes as I could throughout the classes. I also wrote down time in the margin during the observations. While taking notes I would also add my interpretations by using "oc" to indicate observer comments (Bogdan, 1992). As soon as possible after leaving the school, I summarized what happened and filled out Part 4, the summary. During the second half of the year, I added the additional questions around next steps and my own suppositions.

8. subject matter: How well did the teacher seem to know the subject matter?
(draw inferences from teacher's stated goal, stories, explanations used,
questions asked)

9. content difficulty: Does the teacher seem to be aware of inherent difficulties in
content?

10. interactions: How does the teacher interact with the students?

IDEAS TO THINK ABOUT

MAIN THEMES, IMPRESSIONS

EXPLANATIONS, SPECULATIONS, HYPOTHESES

ALTERNATIVE INTERPRETATIONS, EXPLANATIONS, DISAGREEMENTS

**NEXT STEPS for DATA COLLECTION: FOLLOW-UP QUESTIONS, SPECIFIC
ACTION, and DIRECTION OF FIELDWORK**

IMPLICATIONS for REVISION, UPDATING of CODING SCHEMES

APPENDIX F
THE QUELEA PROBLEM

EXCERPTS from THE QUELEA PROBLEM by Graham Lenton

[The QUELEA PROBLEM handout suggests that the unit will take
between 60-70 minutes.]

Plagues of birds: setting the problem

Flocks of a small finch-like bird, the Quelea, inhabit the savanna regions of Africa. The Quelea is a pest bird that can be compared in number with the locust and which devours vast areas of crops such as sorghum, whenever it runs out of its natural grass seed diet.

Sorghum is grown in many regions of Africa. The seeds are ground to provide flour for bread and porridge. Quelea damage the seeds particularly when they are soft.

In this unit you are in the position of a Senior Pest Control Officer dealing with calls for help to combat Quelea damage to sorghum crops growing in Ethiopia. You have limited resources at your disposal and so you have to assess the damage done by looking at samples of sorghum seed heads, evaluate the evidence and decide upon the action to take.

Three calls for help

You are based in Addis Ababa and three urgent requests have come in all asking for help to deal with pest populations of Quelea birds attacking sorghum crops.

Decision time

You may only respond to one of these requests because time and resources are limited. Which one do you choose? Weigh up all the evidence... Decide which is the most deserving case in terms of reliability of information, the most needy request and the one that will probably be most effective. Bear in mind that you will probably have about fifteen requests for spraying throughout the season. When you have made your choice prepare a report which justifies the decision and explains your proposed course of action.

Request 1

Location: Melkassa Village

Situation: A subsistence farmer has three 2 hectare fields of sorghum which are each being attacked by birds each day. He has sent a sample of sorghum [this shows 10% damage] to the bird Control team in Addis Ababa. He keeps a number of cattle and there is drinking water close to one of the fields of sorghum. There is a large Quelea colony of around 60 hectares about 10 miles from Melkassa in dense acacia scrubland.

Request 2

Location: Debra Zeit

Situation: A local field officer from the Crop Protection Department has filed a report that a nesting colony of *Quelea* is beginning to appear in open acacia woodland (not dense woodland) about 20 miles from Debra Zeit. Sorghum is grown around Debra Zeit in large 20 hectare plots. These plots are part of a Government Development Scheme and local farmers have been given grants to aid the development. The field officer has carried out a damage assessment of the sorghum but decided only to assess the first four rows of sorghum and arrived at a figure of 40 per cent damage--a figure in excess of that at which a control operation would be initiated [actual assessment of damage is about 32%].

Request 3

Location: Awash Valley

Situation: One of the field teams from the Bird Control Unit of the Government Crop Protection Department has radioed back to Addis Ababa to say that they have discovered a colony of breeding *Quelea* in the Awah Valley and think they should control it. They suspect that the nearest sorghum 40 miles to the south, at Awash, is at risk and would like damage assessments to be carried out there [the sample shows about 22.5% damage]. They have all the equipment ready, enough Parathion for one spray operation, and a good group support team, but no aircraft or pilot facilities and request that head office organise this for spraying as soon as possible.

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