ELEMENTARY TEACHERS' PRACTICE AND PERCEPTIONS OF A NEW SCIENCE CURRICULUM IN A CULTURALLY DIVERSE SCHOOL SETTING

by

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Elementary Teachers' Practice and Perceptions of a New Science Curriculum in a Culturally Diverse School Setting

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The purpose of this study was to understand the development, dissemination, and use of a new elementary school science curriculum designed by district lead-teachers. The focus was on three participant-teachers utilizing this curriculum at three different grade levels within a culturally diverse school setting. Qualitative data collection (observations and interviews) and analysis, with phenomenology as the basic philosophy, guided this study.

It was concluded that:

- The participant-teachers accepted the validity of an external curriculum, felt obliged to "cover" it, and had a variable understanding of the adaptions they could make.
- The new curriculum conformed with current national reforms, was "teacher proof", user friendly, and student beneficial, although its basic assumptions were unspecified.
- The prevailing school structure and curricular practices remained intact, and both supported and inhibited the teachers' ability to effectively utilize the curriculum.
- The participant-teachers approved hands-on instruction as means to teach science, although were not equally supportive of cooperative group work or subject area integration.
- Curriculum/teachers provided "direct" and predetermined instruction that limited cognitive engagement, although students were excited during activities that increased their curiosity.

- To facilitate student interaction during hands-on instruction, the participant-teachers gave up certain aspects of teacher-directed work, resulting in reenforcement of their belief that children learn when allowed to explore materials by themselves.
- Curriculum-directed assessments emphasized observation of student work; performance of hands-on tasks was assumed to lead to science learning.
- All teachers modified their instruction to meet some of the needs of their students. Special needs and ESL students often received extra instruction in other subjects in place of science.
- The home environment of many students was not considered conducive to learning; hence such students were not expected to do well in the system.
- One aim of instruction was to enculturate the students to learn behaviors perceived as prerequisites for learning science.

dedicated to

my husband, Vipin.

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A.G.A.

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INTRODUCTION

> A comprehensive reform of the science curriculum, and ways of teaching and assessing science instruction, is underway. This reform has been characterized as "deep, widespread, and serious." It is systemic, requiring that all parts of the system be partners in change. It is occurring at the national level, in the states, in schools, and in individual classrooms. Teachers, as well as administrators, policy makers, and community members have a vital role to play in furthering reform. To truly change science education, a widespread effort is required. (Sivertsen, 1993, p. 1)

Introduction

Calls for reform at the national, state, or district level in the area of US science education are nothing new. In 1960 - '70 this nation was bombarded with a variety of science curricula at all grade levels (Lockard, 1977). These science curricula emphasized basic science concepts, nature of science as practiced by scientists, processes involved in the practice of science, and the structure of science as a discipline (Klopfer & Champagne, 1990; Kyle, Shymansky & Alport, 1982; Schwab, 1981; Shymansky, Kyle & Alport, 1983; Yager, 1992). Almost all these science curricula were activity-based; claimed to foster elements of discovery or inquiry and a positive attitude towards science in the minds of the science learner (Shymansky, Kyle & Alport, 1983; Welch, 1979).

Many studies have analyzed the past (1960s and '70s) science curriculum programs and concluded that these curricula were more effective than the then (pre 1955) existing textbook based programs at all grade levels (Butts, Bybee, Gallagher & Yager, 1980; Kyle, Shymansky & Alport, 1982; Shymansky, Kyle & Alport, 1982). At the K-6 level, in particular, the discovery or inquiry based approach in comparison to textbook approach led to higher student gains (Shymansky, Hedges & Woodworth, 1990).

Disadvantaged children benefited more from these programs in comparison to non-disadvantaged children and teachers perceived that these programs were more accessible or adaptable to handicapped students (Atwood & Oldham, 1985; Bredderman, 1982, 1983).

On the other hand, these programs did not affect at all or negatively affected teachers' attitude towards science and less than fifty percent of teachers surveyed in a study were willing to continue to use these programs (Kyle, Bonnstetter & Gadsen, 1988). Overall the impact of these programs was limited and certainly not long lasting (Klopfer & Champagne, 1990). Science was not being emphasized in the elementary schools and science was not being taught, at any grade level, the way the 1960 - 70s curricula suggested science be taught (Stake & Easley, 1978a, 1978b; Weiss, 1978).

Some of the self-reported reasons provided by teachers for the failure of these curricula were problems with procuring, maintaining, utilizing, repairing, and refurbishing materials; student management; and the little attention paid to their (teachers') suggestions related to the curriculum and the materials (Atwood & Howard, 1990; Kyle, Shymansky & Alport, 1982). Also the past science curriculum reform efforts assumed that the intended curriculum reform would inherently change instruction in spite of limited in-service and inadequate science teacher preparation (Aron, 1983; Duschl, 1983; Gerlovich, Downs, & Magrane, 1981; Jackson, 1983). Around the same time (1970s) less than 30% of elementary teachers self-reported that they felt confident in teaching science (Weiss, 1978).

Analysis of the past curriculum reform efforts has further revealed that most of these curricula were: a) designed by scientists and psychologists as the experts focusing on subject-matter knowledge; b) developed at the national level oblivious of the specific context of schools where they were eventually

implemented; c) initiated at the high school level and then modified for elementary grades; d) "teacher proof," that is, provided detailed curriculum such that all the acts of teaching were predecided by the developers (Connelly & Clandinin, 1988; Glatthorn, 1987; Hutchinson & Huberman, 1993; Johnson, 1989; Klopfer & Champagne, 1990; Yager, 1992). These reform efforts disregarded the teachers' practice and thinking about the science curriculum content, the process of implementation, and the actual practice of teaching science (Gallagher, 1991; Shymansky & Kyle, 1992).

Even though "teachers are central to any solutions and successes for current reform efforts," their view-points were often ignored in science crisis reports or they were blamed for the failure of these reform efforts (Yager, 1992, p. 907). In general, past school science curriculum reform efforts have focused "on achievement, assessment, and accountability" but failed to detect the "problems of schooling, nor offered solutions that are pedagogically valid" (Shymansky & Kyle, 1991, p. 14). Often, research in science curriculum and instruction itself is not based on the existing realities of the classroom and is rarely utilized or found useful by the classroom teacher (Shymansky & Kyle, 1991; Wright, 1993).

There is a limited account of the actual development and dissemination process of these curricular reforms (Shymansky & Kyle, 1992). Only recently has any attention been paid to the intricacies of elementary science curriculum as experienced by teachers (Barrow, 1991; Martens, 1992; Mitchener, 1991; Tobin, Briscoe & Holman, 1990; Tobin & Jakubowski, 1992). These studies provide an in-depth picture of elementary science curriculum and implementation as experienced by teachers and further recommend a need to better study, document, and understand this process.

Never is it more urgent than today that science curriculum reform

efforts acknowledge and cater to the changing needs of the teachers and the students in the classrooms of the US (Hodgkinson, 1993). Reform efforts are also a necessary on-going process to reevaluate science curricula and instruction in light of different perspectives on how children learn science (Bybee & Sund, 1982; Glasersfeld, 1992; Phillips & Soltis, 1991; Yager, 1991).

Current (1980s and 1990s) science curriculum reform efforts claim to be not only cognizant of past and current research and practice but committed to: (a) active involvement of teachers, other components of school systems, and society in this process; (b) consideration of the changing socio-economic make-up of students; and (c) taking advantage of new insights into learners' role in their own learning (Aldridge, 1992; American Association for the Advancement of Science (AAAS), 1990; Sivertsen, 1993).

It is with this awareness that many school systems in coordination with other components of the society are actively engaged in transforming their science curriculum. Different components of the school system, including teachers, are designing curricula for other teachers in their districts (Ahlgren & Rutherford, 1993; Marcuccio & Marshall, 1993; Mitchener, 1991). However, under the existing circumstances, all teachers cannot possibly be directly or intensively involved in the curriculum development process. A considerable percentage of teachers continues to play the key role of users of curricula designed by others, including their peers. It is the classroom of these user-teachers that is the arena for the intended curriculum to be adapted and transformed into instruction. Undoubtedly "...only teachers can provide the insights that emerge from intensive, direct experience in the classroom itself" (AAAS, 1990, p. 212).

Traditionally, teachers have not been recognized as important components of curriculum development or implementation even though

undoubtedly they are the key players in the picture (Gallagher, 1991; Mitchener, 1991). After all, it is the teachers' classroom where the actual process of curriculum implementation, adaptation, and transformation happens. In spite of lack of power outside the classroom and little control over scheduling, it is the teachers who regulate what happens in their classrooms. Teachers have the responsibility, if not the ultimate power, to determine how an intended curriculum is adapted and transformed into instruction. "They bring to the task of reform a knowledge of students, craft, and school culture that others cannot" making teachers paramount to any science curriculum reform effort (AAAS, 1990, p. 213). This is not to deny all other socioeconomic and political complexities of the schooling enterprise or the intricacies of the implementation process but to admit that "...teachers are central" to any curriculum reform process (AAAS, 1990, p. 213).

If teachers are central, then the sense that they make out of their experiences is central too. Therefore, the interactions among teachers, students, and the intended curriculum becomes a central issue worth exploring. Consideration of teachers' instructional practices, interactions with the intended curriculum and students, and teachers' own perceptions will illuminate the science curriculum reform process happening in a particular setting. Researcher's interpretations, along with teachers' perceptions, will shed a new light on this complex and intriguing process.

Purpose of the Study

The purpose of this study was to (a) understand the development and dissemination at the district level of a new elementary school science curriculum designed by teachers, and (b) interpret the science instruction of three teachers in the process of utilizing the new curriculum at three different grade levels within a culturally diverse elementary school setting in the same district.

Meaning of Terms

The following description may help the reader to discern the meaning that has been associated with certain common terms in this work:

Culturally Diverse Setting: School setting at which student population contained more than 80% with low socioeconomic backgrounds, more than 30% were ethnically/culturally diverse, and about 20% with English as Second Language, that is, no or limited proficiency in English. The school district used the term Chapter 1 school as synonymous with "Culturally Diverse Setting." Chapter 1 meant that the school received economic aid in form of Chapter 1 Federal Grants. Additional teachers working under this grant were called Chapter 1 teachers.

User-Teachers: Teachers who use the curriculum designed by others.

Participant-Teachers: Three user-teachers who participated in this study.

Lead-Teachers: Group of 10-12 teachers within the district who were on the team that developed and disseminated the new elementary science curriculum.

Curriculum Development: A district level process of designing and writing a new curriculum involving different components of the system, including teachers.

Curriculum Dissemination: A district level process of providing in-service and facilitating the dissemination (distribution) of the new curriculum in the schools. At times the term "curriculum implementation" was also used to describe the same process.

Curriculum Adaption: Teachers' process of accommodating the new curriculum: as to how teachers add to, delete from, or change the curriculum to meet their own and their students' needs. This happens both at the school and the classroom level.

Curriculum Transformation: Teachers' process of utilizing the curriculum in their own classroom focusing on how they adapt the curriculum and eventually transform the curriculum into instruction (teaching practice).

Thus, in this study the two terms "curriculum development" and "curriculum dissemination" were used solely in association with the district. In the educational literature, district developed and disseminated curriculum is often called the "intended curriculum" (Cuban, 1992, p. 222). On the other hand, the two terms "curriculum adaption" and "curriculum transformation" were used solely in association with the school, classroom, and the individual teachers. In literature teacher adapted and transformed curriculum is often called the "taught curriculum," that is, what teachers practice in their classrooms (Cuban, 1992, p. 222).

Research Questions

The grand tour question was:

> How did the district develop a new elementary science curriculum and disseminate it into the classrooms of practicing teachers; and how did teachers, in a culturally diverse setting within the district, utilize this new curriculum?

As the study evolved, the researcher and the participant-teachers focused on issues particular to this setting. With passage of time, more specific questions were conceptualized (Goetz & LeCompte, 1984). The specific questions included:

1. What was the elementary science curriculum development and dissemination process like at the district level?
2. How did the three participant-teachers adapt the new district elementary science curriculum?
3. How did these teachers transform the adapted curriculum into instruction?

4. What were the various elements of this transformed instruction?
5. How did these teachers' perceptions of the needs of their culturally diverse students influence their utilization of this curriculum?

Research Question Assumptions

The qualitative research approach demands that no *a priori* assumptions be made regarding the setting or the phenomenon under study; rather a self-conscious attempt be made to analyze researcher's preconceptions and biases (Erickson, 1973; Goetz & LeCompte, 1984). The researcher conducted regular self-reflective sessions whereby she looked within herself and searched for biases or assumptions that she was making. At the beginning, research questions were conceptualized with the assumptions:

1. There is a difference between the intended (district developed and disseminated curriculum) and the taught (teacher adapted and transformed) curriculum.
2. Teachers play the primary role of transforming the intended curriculum into instruction (practice).
3. Culturally diverse settings are different from mono-cultural settings and this difference influences the process of curriculum adaption and transformation.

Researcher Background

The present study evolved as a result of researcher's personal and professional experiences. Thus, it becomes important that I, the researcher, share my background and the assumptions I made (Jansen & Peshkin, 1992; Miles & Huberman, 1984). My perspectives on practice of doing and teaching science developed from my experiences (a) in India, as a student of science, a researcher in a postgraduate (graduate, in the US terminology) chemistry laboratory, a research chemist in a drug manufacturing concern, and a teacher of science at college, senior high school, and junior high school level; (b) in

the US, as a graduate assistant for elementary science methods course, and a supervisor of student-teachers at the K-12 level; and (c) in a mid-western (US) suburban elementary school as a researcher conducting a collaborative pilot-study with one teacher experiencing a conscious change in her science instruction. These experiences made me aware of the gap between how science is practiced in laboratories, how it is taught in schools, and how it is experienced in the society.

Qualitative Paradigm Assumptions

Besides the self evident assumption that I, a science teacher from another country (India), can understand what a teacher within the US does, there are some other assumptions, including:

1. Teachers can be and are conscious of the processes they experience and the role they play within that process.
2. Teachers, if provided with the time and the resources, can articulate their experiences.
3. A researcher can see, listen, write, and share with the teachers what she observed, thus acting as a reflecting mirror for the teachers.
4. This practice will make the researcher and the teachers more aware of their practical knowledge and enable them to learn from each other.
5. Initially the researcher will be an intruder in the classroom setting, but with time will become just another part of the setting; she eventually will be a resource for the teachers and may influence the setting.

Delimitations

Three volunteer elementary teachers from the same school building participated in this study. They were utilizing science-kits newly developed by other elementary teachers in the same district. These teachers were willing to let me be in their classrooms and share their experiences with me.

Volunteer teachers were purposefully sought by approaching the school principals of all the fifteen Chapter 1 (culturally diverse) elementary schools within a school district in a mid-sized city in the mid-western US.

Limitations

My own and the participant-teachers' perceptions based on our experiences limit this study. In my work I have not presented the "truth" but a more "informed and sophisticated" construction that confronts as well as connects existing views (Guba & Lincoln, 1989, p. 46).

The analysis of observations, interpretations, and perceptions were the prime source for the conclusions. The result was a holistic portrayal of the multiple realities as constructed by the participants and the researcher (Lincoln & Guba, 1985; Mathison, 1988). All my field notes and memos explicitly identify my interpretations as such.

Researcher sensitivity and integrity further limited this study. I was sensitive to the needs of the participants. These participants were unique people and I did not undermine their trust in me. Collected and analyzed data were regularly shared with them and used as a means to initiate dialogue. They were also provided with a copy of this document and their response is included in Appendix M. Participation of the teachers was crucial to this study; they had to take the risk of letting me in their classroom, and, moreover, spend valuable time in sharing their perceptions with me.

Information resulting from this study was useful to the particular setting where it emerged from, especially concerning issues that were most important to the participants. However, every attempt was made to fully describe the setting, the phenomena under study, the data collection, and the data analysis process so that the reader "interested in transferability has a base of information" to make informed choice (Lincoln & Guba, 1985, p. 124).

Significance of the Study

Past research on elementary science curriculum implementation deals mostly with the study of the results of national programs or local staff-development projects to measure changes in predetermined factors or surveys (Atwood & Howard, 1990; Bredderman, 1982, 1983; Butts, Bybee, Gallagher & Yager, 1980; Kyle, Bonnstetter & Gadsen, 1988; Kyle, Shymansky & Alport, 1982; Shymansky, Hedges & Woodworth, 1990; Shymansky, Kyle & Alport, 1982a, 1982b). Predetermined factors such as student test scores or responses to predecided questions was the main criteria for determining the success or failure of reform efforts. These studies provide valuable insights into the changing process of science curriculum and instruction, and provide various theories "about how change and improvement happen" (Holdzkom & Lutz, 1986, p. viii). However, a close look at most school improvement efforts "reveals that those theories aren't being used in many school improvement efforts" (Holdzkom & Lutz, 1986, p. viii). Classroom teachers rarely utilize or find science curriculum and instruction research useful (Wright, 1993). One of the reasons could be that research in science curriculum and instruction itself is not based on the existing realities of the classroom (Shymansky & Kyle, 1991).

Not enough attention is paid to what teachers know and can articulate to better understand the issues from their viewpoint. Teachers are the people who are in direct touch with the complexities of the existing classrooms. Teachers do not want "simplistic answers to problems that they have not defined" (Holdzkom & Lutz, 1986, p. ix). Recently efforts have been made to go beyond studying predetermined factors and focus on teacher perceptions and practice (Barrow, 1991; Martens, 1992; Mitchener, 1991; Tobin, Briscoe & Holman, 1990; Tobin & Jakubowski, 1992).