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ABSTRACT

The purpose of this study was to compare and contrast significant features of the multiple layers of policy statements and objectives comprising the intended curriculum of a chemistry class. Levels of this curriculum include state, district, and local school science curriculum policies as well as those of curriculum developers and teacher. An additional objective was to determine the relative influence of each level upon the teacher and his subsequent implementation. Using data collected in a year-long ethnographic study of curriculum modulation within a Department of Defense Dependents Schools high school on an overseas military base, matrix was constructed to form a composite of the levels in terms of objectives, recommended instructional methodologies, theoretical perspective, and science curriculum emphasis. Preliminary findings suggest areas of inconsistency and contradiction between the levels, creating an uncoordinated system of intent. It was found that the teacher chose to ignore the outer layers of intended curriculum and implement the chemistry curriculum according to personal objectives with some input from the text and associated materials. (Author/MKR)

For All Intents and Purposes:
Probing the Levels of Intended Curriculum for a High School Chemistry Class

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Abstract

FOR ALL INTENTS AND PURPOSES: PROBING LEVELS OF INTENDED CURRICULUM FOR A HIGH SCHOOL CHEMISTRY CLASS

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The purpose of this study was to compare and contrast significant features of the multiple layers of policy statements and objectives comprising the intended curriculum of a chemistry class. Levels of this curriculum include state, district and local school science curriculum policies as well as those of curriculum developers and teacher. An additional objective was to determine the relative influence of each level upon the teacher and his subsequent implementation. Using data collected in a year-long ethnographic study of curriculum modulation, a matrix was constructed to form a composite of the levels in terms of objectives, recommended instructional methodologies, theoretical perspective, and science curriculum emphasis. Preliminary findings suggest areas of inconsistency and contradiction between the levels, creating an uncoordinated system of intent. It was found that the teacher chose to ignore the outer layers of intended curriculum and implement the chemistry curriculum according to personal objectives with some input from the text and associated materials.

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Objectives

As part of a larger ethnographic study of the process of curriculum modulation in a chemistry class, this section's purpose was to describe the intended curriculum to be implemented by the teacher. It was immediately obvious that the intended curriculum was a multi-layered construct formulated by various administrative levels, the text writers, and the teacher himself. In addition, some features of these multiple layers often appeared inconsistent or contradictory. Therefore, the objectives of this study were to (a) compare and contrast significant features of the intended chemistry curriculum presented by the state, district, and local school administrations, the chemistry curriculum developers, and the teacher himself; and (b) to determine the relative influence of each level on the teacher's formulation of the intended curriculum and his subsequent implementation.

Theoretical Framework

Curriculum of a classroom, school, district, state, as defined by Cuban (1992) is "a series of planned events intended for students to learn particular knowledge, skills, values and organized to be carried out by administrators and teachers" (p. 221). For the purpose of this study, curriculum is divided into three domains - the intended, the implemented, and the learned (Cuban, 1992; Duschl, 1990; Gehrke, Knapp & Sirotnik, 1992). Each domain intersects with the next to form a sequence of events in which curriculum, teacher and students are major participants, the process of curriculum modulation (Roberts, 1984, 1988). Internal stakeholders, i.e., the state and/or district school administration, local school administration, curriculum developers and teacher contribute to the formation of a vision of the intended curriculum (Duschl, 1988). As a function of the teacher's knowledge, beliefs and pedagogical actions, the implemented curriculum domain represents the teaching of the curriculum, influenced in part by the curricular images of the intended domain. Finally, the learned curriculum is described as the sum of the students' learning in the areas of concepts, skills, attitudes, cognitive abilities, and understanding the nature of science.

The intended curriculum is usually described as a combination of statements of purposes, content, organization, and practice - the 'formal' or 'adopted' curriculum found in documents prepared by various levels of school policy makers. Cuban (1992) and Cornbleth (1988) perceive these levels as nested within one another, with much overlapping and interplay. In addition, the curriculum writers and teacher bring conceptions of an intended curriculum to the classroom. By placing the state educational policy makers as most distant from the teacher at the center of the domain, the semipermeable layers of the intended curriculum construct are labeled state, district, school, curriculum materials, and teacher. This arrangement, at least in the present study, is consistent with both the literal and figurative distance of each level of intent from the central mediator of the curriculum - the teacher.

The intended curriculum delineates which knowledge, skills and values are most worthwhile in a certain content area. It also often recommends a teaching style best suited to reach stated objectives (Cronin-Jones, 1991). In addition, implicit messages about theories of schooling, teaching, learning and knowledge are associated with an intended curriculum (Mahung, 1984). Focusing on science, Roberts (1988) created seven curriculum emphases which characterize "meta-lessons" (p. 33) embodied in science curricula. Use of these emphases to analyze curriculum frameworks enables the researcher to identify their implicit messages of purpose in answer to the question "What counts as science education?"

Design and Procedures

Method

The study of curriculum modulation necessitates ecological perspective in which an understanding of curriculum is formed by interrelationships of all participants and contexts in the teaching-learning process. In keeping with this, an ethnographic methodology was chosen to investigate the diverse factors in transformation of a chemistry curriculum from the domains of intended through teacher implementation to student learning. I became a participant-observer in a high school chemistry class for school year 1993-94. Data collected included daily field notes, entries in a personal journal, transcripts of formal interviews, and various documents. For this section of the study, interviews were conducted with the district science coordinator, the school principal, and Mr. London (a pseudonym), the teacher. Published curriculum materials were collected from all available sources - the 'state' course description standards guide, the district science objectives, the local school course description handbook, and the teacher's reference and ancillary materials for the adopted text, *Chemistry, The Study of Matter* by Dorin, Demmin, and Gabel (1992) published by Prentice Hall.

Setting and Participants

This investigation was conducted in a chemistry class within a Department of Defense Dependents Schools (DoDDS) high school - Victory High School -on an overseas military base. The school has an enrollment of approximately 700 students in grades 7-12, the majority American military dependents. Chemistry was offered in three sections per day to an average of 22 students per 50-minute class. Most students were juniors concurrently enrolled in advanced mathematics. Since only two years of science are required for graduation, students who select chemistry are revealing their intent to attend college. Chemistry class was conducted in a well-equipped room with six lab stations. The chemistry instructor Mr. London (all person and place names in this study are pseudonyms) volunteered for the study. A veteran of sixteen years of teaching science and math, he taught senior physics and ninth grade physical science at this school for six years. Although this was his first year to teach a full time chemistry class, he had taught the basics of chemistry during the second half of the physical science class. Mr. London demonstrated a positive attitude and a strong command of subject matter.

The school principal, a veteran of twenty years of administration, was in his third year at the school and was rated highly. The district coordinator had been in place for seven years. The current regional science objectives were formulated under his guidance in 1992.

Data Analysis

"The intended curriculum is a map of theories, beliefs, and intentions about schooling, teaching, learning, and knowledge" (Cuban, 1992, p. 222). However, the intended curriculum is not so easily identified for the classroom teacher who is laboring under instructional frameworks created by many levels of school administration and curriculum developers. In this study, a search for the essential intended curriculum revealed published curricular materials from the main, or state, office, the regional science office, the local high school, and the adopted text. In order to more clearly define these levels, representatives of the region and school, the science coordinator and principal, were interviewed. Finally, the teacher discussed his intended curriculum in our initial interview and then continued to elaborate his intentions for instruction in both formal and informal interviews throughout the school year.

The data sources were analyzed in terms of elements of the intended curriculum which have been identified in research literature. First, the 'what' of the intended curriculum is written in objectives or outcomes representing desired content, or core knowledge. The 'how' of the curriculum may be described in recommended teaching styles or instructional methodologies. Finally, the 'why' is explicitly or implicitly communicated in the form of a rationale, statement of purpose, or theoretical perspective.

For analysis, data sources were organized in rows in a two dimensional array. Columns consisted of the elements of an intended curriculum - Objectives/Outcomes/ Content; Teaching style/Instructional Methodology; and Theoretical Perspective/Rationale/Purpose. Next, a column was included for the identified "science curriculum emphasis" created by Roberts (1988). Data from the published materials, interview transcripts and fieldnotes were collected and entered into the appropriate cells of the matrix, forming a composite of the intended curriculum impacting upon Mr. London in his chemistry class.

Results and Discussion

Levels of Intent - What Counts as Chemistry Education?

In seeking the source of the intended curriculum for the present study, I discovered that Mr. London was confronted with many documents which purported to define the high school chemistry course in the school system and in Victory High School. In addition, the adopted chemistry curriculum contained lengthy descriptions of the authors' philosophy, recommended teaching strategies and content. Finally, Mr. London's personal system of intent for the chemistry class had to be taken into consideration. How does a teacher cope with all these spheres of influence? What choices does he make? What is the nature of the intended curriculum finally constructed for the classroom? The model of the intended curriculum as an amalgam of content, instructional methodology, and theoretical perspective (Cronin-Jones, 1991) is used to analyze the levels of influence. The theoretical perspective is identified using Robert's (1988, 1982) seven curriculum emphases which categorize explicit and implicit messages about the purposes for learning the content of a particular curriculum. A brief description of Roberts (1988;1982) curriculum emphases is followed by .portrayals of the five levels of intent as they appear in the matrix in Figure 4 A Comparison of Levels of the Intended Chemistry Curriculum.

1. **Everyday Coping** - emphasizing the importance of science for understanding and controlling one's everyday life. This view emphasizes knowledge of technology and the environment in order for students to function in society.
2. **Structure of Science** - presents ideas about the nature and development of scientific knowledge i.e., "how science functions as an intellectual enterprise."
3. **Science, Technology and Decisions** emphasis, analogcus with the science, technology, society movement, explores practical decision making in relation to matters of importance in modern society.
4. **Scientific Skill Development** - presents experiences such as observation, mea :urement, and experimenting to define the process of science through inquiry.
5. **Correct Explanations** emphasis - stresses the products of science, accepted theories that one must 'master now, question later'.
6. **Self as Explainer** emphasis presents science as a historical, cultural development of ideas by examining conflicting viewpoints and their influence in the process of scientific explanation.
7. **Solid Foundation** - presents content as a basis for future science studies. (Roberts, 1988)

A. 'State' Curriculum Framework

Official educational policy for the large school system is published in the *Learning and Course Description Standard Guide,* April 1989. This volume serves as a planning and monitoring guide for teachers and administrators and as a description of instructional programs for interested parties. As a curriculum framework, it is organized by course, listing content, instructional activities, major evaluative techniques and essential objectives for each. Chemistry I lists four major concepts, nine essential objectives and major instructional activities including laboratory experiments to introduce topics, emphasis on problem solving, and repetition of fundamental concepts. More in consideration of what is not included in the Course Descriptions Standard Guide, the science emphasis within this publication closely matches Roberts' (1988) Correct Explanations. A definitive block of concepts is presented as necessary for preparing students for life after graduation.

B. District Science Objectives

The 'district' or regional publication *Science Objectives 1993 - 2000* is "a guide for planning, development, implementation and evaluation of the science education program" from kindergarten through grade 12. The foreword suggests use of the volume as a focal point of science programs around which a variety of activities should be used as aids to learning. Both the foreword and science mission statement contain popular terminology such as 'hands-on', 'scientifically literate', 'technology' and 'responsible citizens'. Six major program strands describe objectives for producing competent high school graduates. Chemistry I, included under strand IV - "ACQUIRE, COMPREHEND, and APPLY scientific knowledge - its concepts, theories, principles and laws" - contains fifteen objectives, many of which match those from the state framework.

Closely related to the objectives is the science coordinator under whose direction they were revised for the current science cycle from 1993 - 2000. Describing his job as "anything that has to do with science", he says he can be involved in "hiring teachers, transferring teachers, firing teachers -- everything" as well as choosing and implementing curriculum. (SC1). In his view, the textbook is not the curriculum; the objectives are the curriculum. In other words, as professionals, teachers should use the text only as an aid to presenting a course built around the objectives. The course should interest the students, meet their needs, and allow them to succeed.

Because of the emphasis by both the science coordinator and the regional "district" science objectives upon relating science courses to all aspects of students' lives, the science emphasis entitled Everyday Coping is most applicable. However, inconsistency is apparent to the teacher in the fact that this publication presents the longest list of chemistry topics to be covered within the year long course.

C. Victory High School Mission Statement, Goals, and Course Descriptions

The school's mission statement concludes with the intent for students' "success in a constantly changing society." Goals include development of skills, responsibility, and opportunities for development of physical, mental and emotional health. Course descriptions briefly list major topics to be covered in each class. Those included for Chemistry are identical to the Essential Objectives from the state publication, omitting the final one for describing carbon compounds and reactions.

The principal serves as a mediator between the local departments and the regional office. "I have some input into the kinds of courses that we're going to have, and that goes in concert with what the departments request and what DoDDS is asking us to do" (P2). He is involved in monitoring the programs in the school, so "students who are going through our curriculum are going to be at the proper levels, education-wise, when they exit those courses, that the study guides or curriculum says we're going to have them in. And that those curriculums that we're putting place do in fact meet the needs of our student population" (P4). Curriculum coordinators, he says, have a role in "validating" the curriculum - "when they come into the school,...they're making sure that the school is in fact following the approved courses of study that DoDDS has implemented, and that what is going on in the classroom is what is in fact stated in our curriculum guide.." (P4). The principal emphasized meeting the needs of the student population, making sure the proper information is covered, and preparing students to compete with any other students upon graduation. One way in which he monitors this is to check the failure percentages of each teacher's classes. If these percentages are considered too high, the principal counsels the teacher on 'appropriate expectations' for students to ensure success. Thus, the principal's role in curriculum matters is predominantly regulatory at Victory High School.

With a relatively short list of chemistry topics promised to the student, a mission statement and goals directed toward "developing students' physical, mental, and emotional health" for "success in a constantly changing society", Victory High School's science emphasis is also designated as Everyday Coping.

D. Official Chemistry Curriculum

The Teacher's Guide for Dorin, Demmin and Gabel's *Chemistry - The Study of Matter* (Fourth edition, 1992), opens with an extensive introduction presenting the authors' philosophy and three basic goals - that students learn the facts, formulas and principles; that students understand the underlying basic concepts; and develop critical-thinking and problem-solving skills to extend to everyday life. A constructivist perspective is obvious in the emphasis to guide students to "actively construct their own mental models of the basic concepts" (p. TG-14) Recent educational research findings are employed to explain appropriate teaching strategies. Although the text appears encyclopedic in content, the authors suggest the teacher "focus on a few concepts, but in greater depth" (p. TG-15), find a "teaching pace that will maximize learning" (p. TG-21) and consider the ability level of the students.

Both Structure of Science and Scientific Skill Development appear to be appropriate science emphases for this chemistry curriculum. Inclusion of laboratory activities; science, technology, and society issues; and sections such as Chemistry and You, biographies of scientists, and project suggestions, chemistry is presented as an "intellectual enterprise" (Roberts, 1988).

E. Mr. London's Intended Chemistry Curriculum and Aspects of Implementation

The model of the intended curriculum as an amalgam of curriculum content, preferred teaching style and theoretical perspective (Cronin-Jones, 1991) is used to describe Mr. L's intended chemistry curriculum. First, Mr. L chose to rely on the newly adopted chemistry text for content objectives.

> "We're supposed to be covering a little bit of everything. For chemistry it's basically set. Density, how we use equipment, the basic concepts of chemistry, which is pretty well set. I feel that the authors of the book are professional people and they have written this book, so I tend to follow pretty much what the author is doing." (LI:5).

Mr. L's theoretical perspective for this curriculum was an outgrowth of his ideas on the role of the teacher, the role of the chemistry student, his theories of learning and of the nature of science.

> "They are supposed to ask me questions. I'm there as their helper. So their learning is their business and their job, so what I'm doing - I want to try and stress more that they need to ask me questions - and to use me. I shouldn't have to go ahead and push them. They know that they have to do certain things. (LI:4).

Mr. L. hoped that as self-regulated learners with college education as a goal, the students would learn "how things work and being able to use the tools to make an interpretation." His emphasis was on creative investigation using the concepts from the book as a basis for exploration. "It's kind of investigating and thinking, trying to think your way through things."(LI:3). He often gave advice on how to succeed in college in such areas as studying, preparing for tests, and talking to professors.

In elaborating his intended curriculum, Mr. L revealed his theories about learning. Confusion is a term he frequently used - both in interviews and in the classroom with students. Mr. L believed that confusion in the Piagetian sense was a necessary starting point for learning. "First of all, I like them to attempt to read it so they get good and confused, and then we'll go back through it and I'll ask them questions."

In addition, Mr. L viewed student construction of scientific concepts as a process of elaboration through time. "And hopefully they remember some of what they have in the back, because...we're going to pull on that information. And if it's in their pigeon holes somewhere, it'll be fuzzy there, but they'll remember it." (LII:13). Repetition and elaboration of ideas, Mr. L. feels, lead to learning. "I think they have to hear it, .. they have to write it, they have to get confused..." (p. 9). Thus, through the steps of confusion, reflection, logical thinking and review, Mr. L believed students could accomplish meaningful learning. Memorization is not the key to mastery of chemistry concepts. "You could memorize all that stuff, and be able to write it down; that doesn't mean you understand it." (LII:9).

Intertwined with his theories of learning science concepts were Mr. L's views of the nature of science. He conceived of science itself as a process of creative investigation based upon observations, experiment and reflection. The importance of man's sharing of ideas, of scientific development as a social process was another distinctive element of his conception of the discipline. He realized that many students believed that science was magical, mystical, and unrelated to their daily lives. Therefore, he emphasized science as humanistic, as the product of cooperating, curious minds whose goal was to understand the world around them.

It becomes obvious that Mr. L's instructional methodology was an outgrowth of his theoretical perspective and commitments to chemistry content. In his role as helper he hoped to serve as a clarifier of ideas to students who would exhibit their independence in learning through investigative group work, much as scientists do. As a believer in the meaningful construction of ideas through investigation, he emphasized lab work, assigned quarterly projects on topics of personal interest to the students, and emphasized important ideas in multiple ways. The demystification and humanization of science became a primary goal.

> "I'm trying to get them to relax, to realize that it's just a bunch of stuff that we think about, and we give names to it. Sometimes students feel - at least I did --get caught up on a name. And it's not the name, it's the idea behind it. And we just happen to give it a name." (LIV:10)

Finally, the conviction that all the students were capable of learning chemistry was demonstrated in Mr. L's creation of a positive, supportive learning environment in which understanding rather than competition for grades was the motivating factor.

One of Mr. L's goals for instruction was to present chemistry in the Structure of Science emphasis, illustrating the development of the science as a human enterprise. In addition, his emphasis included an element of the Solid Foundation emphasis as he encouraged students to construct a basis for future chemistry study in college.

Conclusions

Doyle (1992), Cuban (1992), Duschl and Wright (1989), Cornbleth (1988), Reynolds and Sanders (1987), and Roberts (1984) describe the formal curriculum presented by school administrations as documents that serve political and managerial functions and are of necessity abstract and decontextualized. The state, regional and school science objectives in the present study match this description. Although the regional or district publication is more detailed and less traditional in intent than the state guide, both present long lists of sophisticated chemistry topics as their objectives. "Educational slogans" (Roberts, 1988) abound. Terms such as 'scientific literacy', 'hands-on', 'responsible citizens', problem-solving', 'constantly changing society' assure stakeholders that the curriculum frameworks are legitimate.

From a teacher's perspective, coverage of the lists of topics in a single school year would be impossible with average students. However, for an administrator, these objectives could be used to control teaching (Doyle, 1992), an internal function served by formal curricula. Both the science coordinator and principal in this study voiced those possibilities. Cuban (1992) describes the principal as "both boss and bureaucrat", caught between levels of administration and teacher, and intent upon "maintaining existing arrangements". In such a position, the principal has neither time nor inclination to foster curriculum reforms, and his role is occasional "monitoring" or "validating" instruction for adherence to administrative policy.

Cohen and Spillane (1992) point out that most administrative instructional frameworks are characterized by "bare listings of course requirements" which are weak with the absence of pedagogy. As a result, "students and teachers have had great latitude in shaping the content and purposes of their courses" (p. 13). The situation thus translates to the autonomy of the teacher which we see in Mr. London's case. He effectively ignored administrative curricular policies, dismissing them as "outdated", and created a chemistry course based upon his best judgements. His actions correspond to Cuban's (1992) analysis of "decoupling" teachers from administration to create a mutually agreeable situation of autonomy for the teacher and credibility for the administration with its constituents.

The text, published in 1992, presents the most complete and contemporary vision of science education and explicates the means of accomplishing its goals. Ideas such as constructivism, student understanding, teacher identification of misconceptions, and 'less is more' permeate the teacher's guide. Cohen and Spillane (1992) interpret the effect of such a textbook which contains many more topics than can be taught in a school year as an invitation to students and teachers to "vary the content they cover" (p. 15). Mr. London deliberately chose the text as his guide in chemistry content. However, he also chose to ignore the extensive commentary in the Teacher's Guide as well as many of the suggested teaching strategies, a course of action which may have limited his options for instruction.

At the core of the intended curriculum is the teacher, recognized as the arbitrator of the curriculum (Cuban, 1992; Doyle, 1992). Mr. London closely matches researchers' descriptions of the professional teacher concerned with the practical rather than the theoretical. He considered the regional objectives "outdated" and he has realistic conceptions of the teaching of topics. Even though his ideas corresponded to those of teachers who Doyle (1992) says "have robust theories of content they use to author and direct curricular events in the classroom" (p. 509), Mr. London did defer to the textbook writers for some decisions on content and sequence.

Duschl and Wright (1989) differentiate between curriculum objectives and personal objectives. Similar to their definitions, Mr. London's personal objectives were characteristically content independent, dealt with long term expectations, and were fewer in number than curriculum objectives.

In conclusion, the intended curriculum for Mr. London's chemistry class was indeed a multi-layered construct. However, the powers of influence exerted by the administrative layers surrounding the teacher in the center were weak. The policies and emphases they espoused were general, inconsistent and often unrealistic for classroom implementation. They were based in the theoretic rather than in the realistic. Recognizing this fact, Mr. London defined his intended curriculum, aided by the textbook. Through his choices, he took the final responsibility for the curriculum. He became the "curriculum creator and adaptor" (Schubert, 1986). Authors such as Connelly (1982), Roberts, (1984) Reynolds and Sanders (1987), and Doyle (1992) expect and commend such actions, recognizing that the uniqueness of the classroom requires tailor-made intentions.

Significance of the Study

Curriculum implementation research has typically evaluated teachers' adherence to curricular goals and postulated the "teacher deficit image" (Roberts, 1988) when instruction did not match intention. As Doyle (1992) points out, little attention has been given to the teachers' perspectives or their conceptions of curriculum. This study of curriculum modulation began with an analysis of the many versions of intended curriculum attached to a chemistry class and concluded that none of them was as influential - or

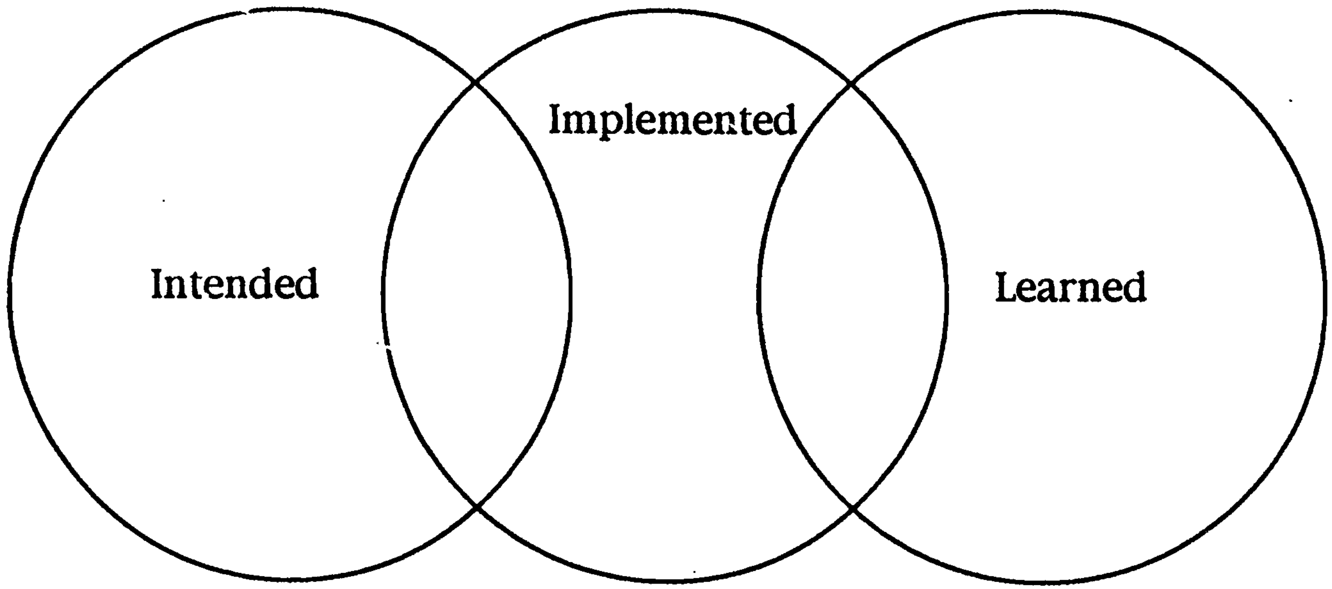
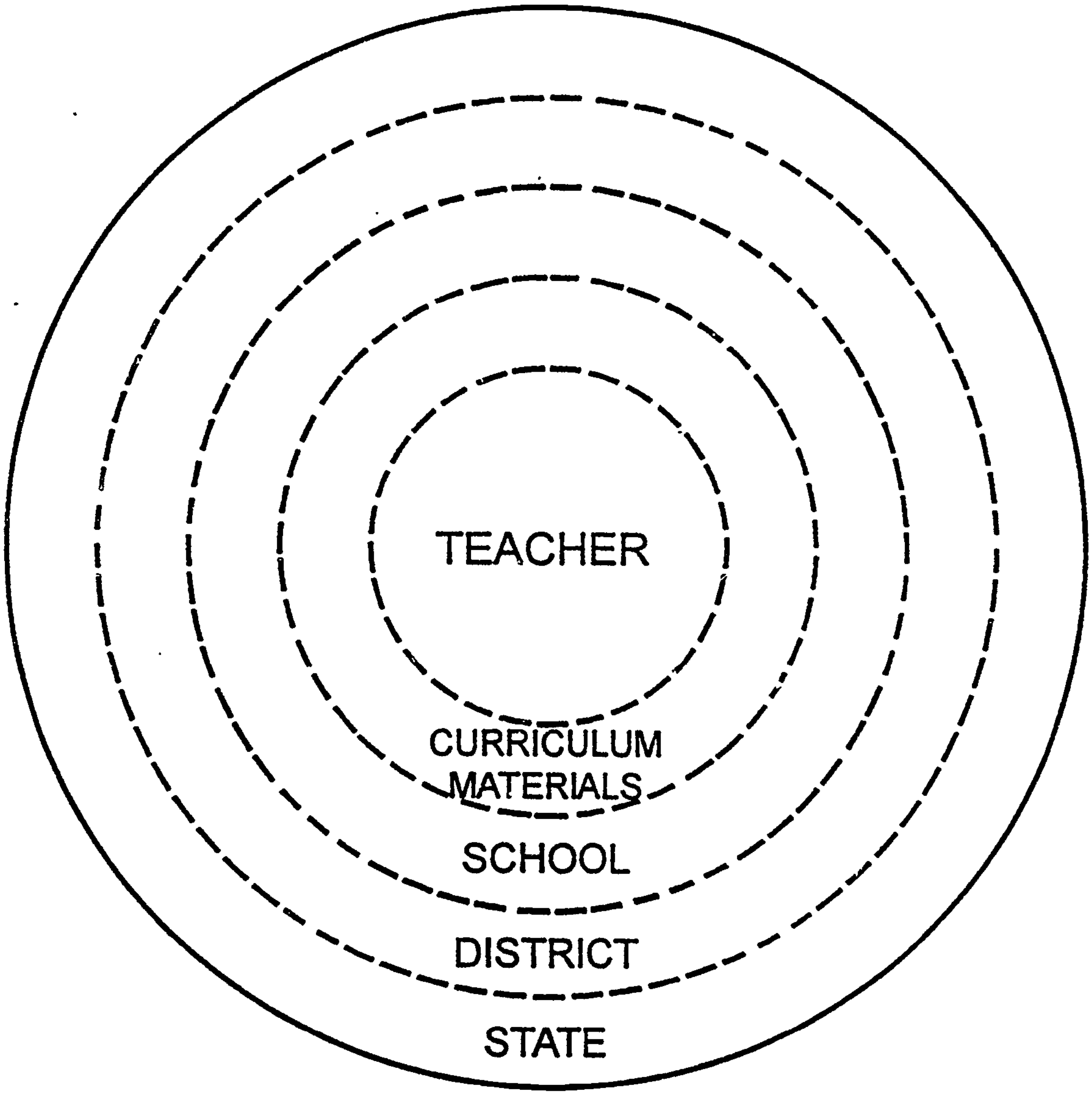


Fig. 1 Domains of Curriculum Modulation



The Intended Curriculum - Levels

A COMPARISON OF LEVELS OF THE INTENDED CHEMISTRY CURRICULUM

	WHAT: OUTCOMES/ CONTENT OBJECTIVES	HOW: INSTRUCTIONAL METHODOLOGY	WHY: RATIONALE/ THEORETICAL PERSPECTIVE	SCIENCE EMPHASIS
State	5 major concepts; nine essential objectives	repetition of fundamental concepts; labs to introduce topics; problem-solving; practice problems.	prepare students who function effectively in a rapidly changing society; teach fundamental concepts	Correct Explanations
District	6 program strands based on values, skills, knowledge; 15 content objectives	hands-on activities; use of text, lab and other activities to help students be successful	prepare students for graduation as responsible citizens; enhance functional understanding of world of science; scientific literacy	Everyday Coping
High School	seven of nine essential objectives from state	Principal: use hands-on activities; vary strategies; motivate; ensure success	produce competent citizens who can compete with other high school grads	Everyday Coping
Chemistry The Study of Matter	facts, formulas, and principles that compose the std. h.s. curriculum; critical thinking problem solving	focus on few concepts at greater depth; use variety of teaching strategies; elicit misconceptions; encourage discussion.	develop understanding; extend problem-solving skills to everyday life; maximize learning	Structure of Science Scientific Skill Development
Teacher Mr. London	facts, formulas and principles that compose the standard high school chemistry curriculum	guide students through content; cooperative learning; labs, projects, repetition of content	stress meaningful learning; college prep; all students are capable; demystify science	Solid Foundation Structure of Science

CHEMISTRY CONTENT OBJECTIVES IN FIVE LEVELS OF INTENDED CURRICULUM

Chemistry Objective	Text Chpt.	State	District	School	Teacher
atomic theory and atomic structure	6	+	+		x
principles of chemical reactions	9, 10	+	+		x
molecular structure	7	+	+		x
solutions and solubility	16	+	+	+	
periodic table of the elements	14	+	+	+	x
chemical bonding theory	15	+	+	+	x
ionization energy	14	+	+	+	x
electron energy levels	13	+	+	+	x
rates of reaction	17	+	+	+	
equilibrium and equilibrium factors	18	+	+	+	
acids, bases, salts	19	+	+		
oxidation-reduction chemical rctns.	21	+	+	+	
carbon compounds and reactions	24	+	+		
mole concept	8		+		x
gas laws	12		+		
nuclear chemistry	26		+		
knowledge of lab equipment	lab book		+		x
chemistry related careers	each chpt.		+		
scientific method	1		+ 7-12		x
graphing	1		+ 7-12		x
measurement with SI units	2		+ 7-12		x
percent error, dimen. analy., sci. not.	2, 3				x
matter (mass, density, phases)	4, 11	+ Phys. Sci.	+ Phys.Sci.	+ SCI. 9	x
energy (forms, heat, temperature)	5	+ Phys. Sci.	+ Phys. Sci.	+ SCI. 9	x

x = intended & implemented

appropriate - as the teacher's personal objectives. Mr. London's position is justified through the analysis and supported by relevant educational literature. This study adds another dimension to the growing bodies of literature on teacher knowledge and beliefs, on curriculum implementation and on recognition of the teacher as knowledgeable, competent professional.

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