AN ASSESSMENT OF INSERVICE TRAINING ON THE APPLICATIONS IN BIOLOGY/CHEMISTRY CURRICULUM FROM THE CENTER OF OCCUPATIONAL RESEARCH AND DEVELOPMENT

By

ROBERT DALE JOBE

Bachelor of Science
Oklahoma State University
Stillwater, Oklahoma
1978

Master of Science
Oklahoma State University
Stillwater, Oklahoma
1987

Submitted to the Faculty of the
Graduate College of
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF EDUCATION
July 1997

AN ASSESSMENT OF INSERVICE TRAINING ON THE

APPLICATIONS IN BIOLOGY/CHEMISTRY

CURRICULUM FROM THE CENTER OF

OCCUPATIONAL RESEARCH AND

DEVELOPMENT

Thesis Approved:

James P. Key
Thesis Adviser

Robert Terry

Ed Harris

Jack Pritchard

Thomas C. Collins
Dean of the Graduate College

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to the many people who made this graduate study possible. First, I would like to thank my advisor, Dr. James Key. Dr. Key's patience, encouragement, and research expertise were major components in the success of my research project. Also, I would like to express my appreciation to the other members of my committee, Dr. Robert Terry, Dr. Jack Pritchard, and Dr. Ed Harris.

I humbly thank my parents, Preston and Mary Jobe, for their love and support through the years, the Christian foundation they gave me, and the strong work ethic they instilled in me.

I especially want to thank my wife and companion, Patricia, for her unfailing love and encouragement through many years of classes, and lots of miles. Thanks for all her typing and spell checks. Thanks to my sons, William and Matthew, for bringing such joy to our lives and for cheering their Dad on.

TABLE OF CONTENTS

LIST OF TABLES

Table	Page

Table | Page

LIST OF CHARTS

CHAPTER I

INTRODUCTION

During the recent period of heightened awareness about the need for educational improvement, broad-based educational reforms have been recommended, such as reorganizing schools to making extensive instructional changes within particular curricular areas. As part of the increased effort to stimulate academic improvement, A Nation at Risk (1983), was one of the first educational reform reports to suggest that our nation's high school graduates need a more solid foundation in the academic basics. The National Secondary Vocational Education Commission (1984) contended that high school students must be more proficient in the basic academic subjects, and believed that one way to make this possible was to place more emphasis on showing students the relevance of the subject matter for which they are responsible. This philosophy was followed for many years by vocational teachers and recently the idea that allowing students the opportunity to apply learning as the most effective way to teach was adopted by many teachers in the academic areas of Mathematics, Science, and Communications.

The national education reform movement took on new meaning at the Charlottesville Education Summit in 1989 when the nation's governors and the President agreed on six national goals for education to achieve by the year 2000. The goals were intended to energize public opinion and ongoing education reform efforts by holding the nation to a much higher expectation for all students and for the schools and learning systems that serve them. The governors and the President envisioned a system that would be 'world class' from early childhood through adulthood.

Late in 1989 the Oklahoma State Board of Regents looked at the success of the state's college graduates and made changes in the entrance requirements and graduation standards, and increased the suggested high school course work for college-bound high school students. The board of regents increased the ACT score requirements and the required high school course work in math and science, believing that it would increase the success rate for students in entry level classes in science and math. This increase in admission standards caused many students to be required to take remedial classes for no credit. Because of the large number of students that did not have the required test scores or course work for college admission, many of the state's high schools began to look at their graduation requirements, types of classes offered, and the teaching method for math, science and communications classes.

As some researchers started to look at the high school curriculum offering within math, science, and communications, they found two types of classes—those that prepared students for college entrance and those that would meet the requirements for graduation. The college-bound students were encouraged to take classes that were more challenging and that would better prepare the students for college level work. Most high schools offered a wide variety of college-bound course work: Algebra 1, Algebra 2, Algebra 3, Geometry, Trigonometry, Biology, Chemistry, Physics, College Prep, and Advanced Placement English and Creative Writing classes for those students that were willing to take the more challenging course work. Non-college-bound students were given watered down versions of academic classes like General Math, Business Math, Consumer Math, Physical Science, General Biology, and Standard English. The students that took the non-college-bound classes did meet the requirements for graduation, but these students were not academically prepared for college or the world of work.

As high schools tried to increase the enrollment in science classes and require more laboratory science credits for graduation and with universities raising the number of laboratory science credits to three for college entrance, many high schools have added Applications in Biology/Chemistry to their curriculum.

In 1991, the Oklahoma State Board of Regents approved the use of high school course work in Applications of Biology/Chemistry for laboratory science credit for college entrance on a temporary basis until adequate research was completed on the merits of the class. High schools could offer Applications of Biology/Chemistry for credit if the Applications of Biology/Chemistry Curriculum written by the Center for Occupational Research and Development (CORD) was used and the teacher of the class has attended an inservice course that was approved by the State Department of Vocational and Technical Education.

Problem

As schools try to implement classes in Applications of Biology/Chemistry, they must employ a teacher who has been trained in the use of the CORD curriculum. Most teachers of traditional subjects agree with the educational value of applied academics, but the actual implementation of the curriculum can be difficult. "Teachers need to understand the curriculum so that problems can be minimized and learning activities can be used to increase understanding and retention rates of scientific concepts by the students. In order to accomplish this goal, educators must understand the different learning styles and provide experiences which fulfill the needs of the learner." (Wilson, 1994, p.4) Because of this difficulty, the type and quality of inservice training is critical and must be monitored for constancy and uniformity of objectives by the presenting instructors.

The workshops of this study had similar instructional format and content because each of the studied workshops were presented by an instructor that either participated in or instructed at a workshop offered at Oklahoma State University. The format was designed to provide instruction on the proper teaching and utilization of the curriculum written by CORD for Applications in Applied Biology/Chemistry. All workshops were taught in a manner that allowed participants to interact with the different areas of the curriculum in a hands-on contextual approach. The time lines of the workshops differed according to the needs of the groups.

Purpose

The purpose of this study was to determine participants' assessment of inservice training workshops for teaching the Applications in Biology/Chemistry curriculum in terms of the extent to which selected outcomes were and should have been accomplished.

Objectives

To accomplish the purpose of the study, a set of specific objectives were formulated and are listed below. The study sought to determine the extent to which participants felt the workshops did and should have accomplished the following:

1. Prepare you to teach a course in ABC for high school credit.

2. Introduce the CORD ABC materials and explain how to use them in a high school class for science credit.

3. Provide examples for time lines and structure of curriculum for a stand-alone course.

4. Explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry.

5. Explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students.

6. Provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom.

7. Define cooperative learning and give examples of ways to utilize it in the classroom.

8. Discuss the challenges of using cooperative learning groups, strategies for grouping students and the structure of cooperative learning activities.

9. Explain the use of the job profiles included in the CORD curriculum.

10. Explain the use of the student activities included in the CORD curriculum.

11. Explain the use of the Activities by Occupational Area in the CORD curriculum.

12. Explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities.

13. Provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies.

14. Explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems.

15. Explain that ABC is a contextual approach to teaching laboratory science skills.

16. Explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work.

17. Provide realistic and useful fieldtrips for any community.

18. The final objective is to develop a uniform set of guidelines for Applications in Biology/Chemistry workshops that could be used for certification by the State Department of Vocational and Technical Education.

Hypothesis

Listed below is the hypothesis which was constructed to achieve the objectives of the study:

Ho1- There is no significant difference between the expected satisfaction and the actual satisfaction of the teachers who attended the different workshops in this study.

Definitions

The following definitions were used for the purpose of this study:

Applied Academics – teaches curriculum using application of concepts to "real-world" problems through the use of hands-on laboratories, text-based activities, and video-assisted activities (CORD, 1993, p.T-2).

Traditional Curriculum - the traditional curriculum approach involving the use the of state adopted textbooks, laboratory manuals, and study guides that were heavily based in the theoretical concepts of biology. The teaching method most often utilized was usually a modified lecture and demonstration followed by students completing activities in laboratory manuals and study guides.

Applied Biology/Chemistry Curriculum (ABC)-Teaching materials for the ABC curriculum consisted of those developed by the Center for Occupational Research and Development (CORD) in Waco, Texas. These materials were comprised of printed text, true story scenarios, job profiles, activities involving real-life situation, practical laboratory exercises, and lists of vocabulary terms. Each unit included a subdivided video illustrating real-life situations which scientific concepts might be applied. Students were encouraged to interact and work in cooperative learning groups while the teacher acts as a guide through the exploration of various topics in the biology and chemistry curriculum.

Applied Biology/Chemistry Curriculum Certification Workshops- Inservice training that is intended to prepare teachers of science to implement the Applied Biology/Chemistry (ABC) curriculum and course materials in the high school. The study of interacting life forms and the study of the composition and properties of substances are investigated as they relate to real, practical application to the social, personal and economic life of the student. Using the Applied Biology/Chemistry science topics as the base the course will supplement and enhance the science knowledge beyond that contained in the course materials and prepare the teacher in the philosophy, methods, materials, scope and sequence of the ABC curriculum.

CORD-Center for Occupational Research and Development. The developers of the curriculum guide for a course in Applied Biology/Chemistry.

Assumptions

1. It was assumed that all workshops were designed to prepare teachers to instruct a course in ABC for High School credit.

2. All graduates of workshops in the study were satisfied with the training and instruction provided in the use of the CORD curriculum.

3. All graduates of workshops in the study were believers in the need for Applied science courses for high school credit.

4. All graduates of workshops in the study were believers in the cooperative learning method and wanted to improve the science aptitude of all students enrolled in science courses.

5. All respondents to the questionnaire were or had been teachers of Applied Biology/Chemistry science courses for high school credit.

Limitations

The number of workshops studied was limited to the number of workshops that the Oklahoma State Department of Vocational Education had record of. The number of teachers enrolled in each workshop was limited to the teachers that were approved by the Oklahoma State Department of Education for certification to teach a course in Applied Biology/Chemistry for high school credit, except for the summer workshops at Oklahoma State University over the last five years.

Scope

The scope of the study consisted of the respondents to a survey sent to the teacher participants of 11 inservice workshops for the Applied Biology/ Chemistry curriculum developed by CORD as the main instruction material. Four different instructors held workshops in Oklahoma that were sanctioned by the State Department of Vocational Education, which certified teachers of Applied Biology/Chemistry classes for high school credit as a laboratory science requirement.

The four instructors held eleven workshops that had one hundred and sixty-one people attending. Fifty-five of the students attending the workshops said they did not intend to teach an Applied Biology/Chemistry course for high school credit. One hundred and six surveys were sent to teachers who attended the workshops. Sixty-two (58%) teachers returned the questionnaire indicating they were or had taught Applied Biology/Chemistry classes for high school credit.

The Workshops

Group 1 presented seven workshops. Each workshop was team taught and included graduate students, agriculture education teachers, and science teachers. They were ten days in duration and had an all day format including actual field trips and cooperative learning modules. Surveys were not sent to participants of this group that were identified as graduate students or agriculture education teachers. A total of seventy-three surveys were sent and thirty-nine (53%) teachers responded and one teacher returned a survey that was left blank, stating he did not wish to participate in the study.

Group 2 consisted of two workshops. The workshops were offered at a regional university for college credit. The duration of the workshops was ten consecutive days with eight hours of daily instruction. Surveys were not sent to participants of this group that were undergraduate students or those who indicated that they were not science teachers. A total of sixteen surveys were sent and 7 (44%) teachers responded.

Group 3 was part of a school-to-work consortium that paid a stipend and was held in the summer to train future applied biology/chemistry teachers for the consortium's schools. The duration of the workshops was ten consecutive days with eight hours of daily instruction. All participants were science teachers. A total of seven surveys were sent and 5 (71%) teachers responded.

Group 4 was part of a workshop presented for a school-to-work consortium. All participants were employed by the consortium and were teaching applied biology/chemistry at the time of the workshop. The workshops were held during the school year and were three two-day sessions in length. Each session was at least a month apart. A total of ten surveys were sent and 9 (90%) teachers responded and one teacher left the survey blank and indicated she did not wish to respond to the survey. The surveys were handed out at the completion of the workshop by the instructor, and participants completed the survey and returned it before being dismissed from the workshop.

CHAPTER II

REVIEW OF LITERATURE

Introduction

During the recent period of heightened awareness about the need for educational improvement, broad-based educational reforms have been recommended, ranging from reorganizing schools to making extensive instructional changes within particular curricular areas. As part of the increased effort to stimulate academic improvement, A Nation at Risk (1983) was one of the first educational reform reports to suggest that our nations high school graduates need a more solid foundation in the academic basics. The National Secondary Vocational Education Commission (1984) contended that high school students must be more proficient in the basic academic subjects, and believed that one way to make this possible is to place more emphasis on showing students the relevance of the subject matter for which they are responsible. This philosophy has been followed for many years by vocational teachers and recently the idea that allowing students the opportunity to apply learning is the most effective way to teach, has been adopted by many teachers in the academic areas of Mathematics, Science and Communications.

As states tried to launch Tech Prep (School to Work) programs in response to the Perkins Vocational and Applied Technology Act (Congressional Record, 101st Congress

2nd Session, September 25, 1990), many schools implemented Applied courses that would incorporate within the classroom real world situations that should better prepare students for the world of work, regardless of the students' post-high school educational plans. Based upon research from the Center for Occupational Research and Development, as of August 1994, Tech Prep was being implemented in every state as well as many countries outside of the United States. Applied Mathematics, Science (Biology and Chemistry), and Principles of Technology (Applied Physics) courses were being taught in over 35,900 classrooms. According to CORD's figures, over 2,337,000 students have been exposed to their applied academic programs. This rapid growth is not detrimental to education if a sound philosophy and mission are developed for these Applied classes. In reality, many of these classes are nebulous and without proper direction. As the Carl Perkins Act comes up for renewal and many universities debate the merits of the Applied courses, perhaps the biggest factor against these Applied courses is lack of established training and certification and a definable curriculum when an Applied course is implemented. Practitioners of the higher level applied courses will jump forward to extol the virtues of the materials as well as demonstrate improved test scores and a decrease in drop out rates of students enrolled in the classes, but the need for mandated training and certification remains.

It is the purpose of this review of literature to establish the need for a minimum set of standards for teaching Applied Academic Courses for high school credit. It will begin with the history of American Education and is followed by Educational Reform Movements, Applied Academics, Teacher Inservice, and A Review of Teacher Training.

History of American Education

Schooling and teaching were neither uniform nor institutionalized during the first century and a half of Europeanized life on the American continent. During this colonial period, teachers were perhaps more nearly their own boss at this time as compared to any subsequent period in history. There was little restraint on the teachers authority ("rule by ferule") (Elsbree 1936, p.71) and physical means were fully accepted. Since the schoolhouse usually only had one room, one teacher, and was physically separated from the community, the teacher had considerable privacy in the conduct of his/her day to day work.

Although the formation of the Republic placed education under state authority, de-facto powers moved to local school boards which gained authority over most facets of the school. Urbanization resulted in the development and spread of multiple classroom schools during the nineteenth century. The teacher's working conditions and status were naturally affected and they lost some of the privacy which had enhanced their independence during the colonial times. Furthermore, "the teacher, those instructing the young became members of the teaching staff employed by the local school board. As school systems multiplied in number and grew in size, they became more bureaucratic. Larger units (schools) required coordination and other administrative tasks, that were assigned to superintendents and principals." Thus the dominant mode of schooling in twentieth century America has become thousands of schools with a hierarchy of offices and some degree of bureaucratic leadership. (Lortie 1969,pg.4).

Teachers became employees supervised by full-time, physically present administrators acting on the authority delegated by the local school board. The authority and power of teachers changed during the early 1900's, laws and school customs changed the relationships between teachers and students. Earlier teachers, as was noted, were expected to use physical force to control their charges; gradually, however, the role of the teacher was redefined as new conceptions of the proper treatment of children arose. During the latter half of the nineteenth century and the early decades of the twentieth, increasingly sharp limits were placed on the teacher's use of physical punishment. There is a paradox in this transformation of values and practices: the teacher's use of physical coercion was limited at about the same time compulsory education became the rule. The presumption that students attended school voluntarily became void just when teachers were forced to maintain their authority through persuasion and other leadership qualities. Discipline took on a different coloration under such conditions: teachers had to learn how to "motive" students regardless of whether they or their parents wished them to be in school (Tyack 1967, p. 470).

Teacher Socialization

Occupations shape people. Scholars have discussed the profound influence work has on the human personality. Modern sociologists and psychologists have provided us with studies of how people are affected by their occupational pursuits (Taylor 1968, p. 45). We have learned that conditions of entry play an important part in socializing members to a given occupation; and we expect those who study work to pay close attention to both formal and informal processes of induction (Lortie 1969, p. 25).

School teachers actually begin the socialization process in their early school years. It is easy to overlook the ways general schooling prepares people for the world of work. Such an oversight is especially serious with public school teachers, for participation in school has special occupational effects on those who do move to the other side of the desk. There are ways in which being a student is like serving an apprenticeship in teaching; students have protracted face-to-face and consequential interactions with established teachers.

Those who teach have normally had seventeen or more years of continuous contact with teachers and professors. American young people see teachers at work much more than they see any other occupational group; it can be estimated that the average student has spent at least 13, 650 hours in direct contact with classroom teachers by the time he graduates from high school. This seventeen year relationship between teacher and student requires that the student project himself into the teacher's position and imagine how he feels about various student behavior, and anticipate or predict the teacher's probable reaction to that behavior. What students learn about teaching, then, is intuitive and imitative rather than explicitly analytical; it is based on individual personalities rather than pedagogical principles. When surveyed, some beginning teachers stated that they were influenced greatly by respected former teachers, and many believed that teaching is not an arcane or scientific undertaking; in short, those who have been good students are equipped to be teachers(Mason 1961, p.34). Teaching is unusual in that those who decide to enter it have had exceptional opportunity to observe members of the occupation at work; unlike most occupations today, the activities of teachers are not shielded from students. Teachers-to-be underestimate the difficulties involved in the teaching of students for long periods of time.

Some socialization of school teachers takes place during the teaching apprenticeship called practice teaching. This is usually a undergraduate experience that is a short and relatively simple affair in which a college student works alongside an established teacher and teaches classes under his watchful eye. But it is interesting that Mason's national study of beginning teachers shows that despite its limited duration, most teachers rank practice teaching ahead of courses in education in usefulness. After analyzing his data, Mason concludes that "practice teaching was valued by all types of beginning teachers," and that practice teaching was more valued than education courses (Mason 1961, p. 45). It would be unwise, however, to credit practice teaching with more impact on teacher socialization than its form permits. Practice teachers normally work with one teacher and thus get a limited view of teaching techniques. Another problem with the socialization influence of practice teaching is that there is no assurance that the supervising teachers are selected for ability to explain the underlying rationales for decision-making on curriculum selection or teaching methods utilization.

Teacher education courses should provide students with much of the socialization and skills needed to be successful in the classroom. Student teachers agree that mastery of subject matter is important, and 36 percent of the respondents to a National Education Association study, complained that they did not have sufficient instruction in "teaching methods", and criticized the practical methods courses on two grounds: instruction is too theoretical and the intellectual content is thin, and they said that the courses are repetitive and boring (Hermanowicz 1966, p23).

Traditional Teaching vs. Effective Teaching

Our teachers have been operating for the last 100 years on the assumption that learning could be controlled—that they could control what students learn, how they learn it, where they learn it, and when they learn it. Schools and classrooms were organized to be effective and efficient delivery systems for a quality-controlled product. We borrowed language and practices from the factory model of the industrial age to develop an organizational structure in which the students were the raw materials subjected to an assembly line process of education inputs that we hoped would produce a marketable finished product from a majority of the students. Schools have spent much time and effort in trying to precisely measure just how much learning the teachers and the school staff have managed to impart on the students during the schooling process. The similarities between the industrial factory and the traditional school can be seen in many aspects: the timetable, the bells, the specialization of the curriculum, the isolation of the teachers, even the structure of the classroom (Clarke 1988, p.76). Students are not inert raw materials, and learning cannot be so easily controlled.

As we are rushing headlong into the information age and the twenty-first century, we realize that the traditional organization of the factory model school no longer fits with today's reality and with what we now know to be true about how people learn. Learning can take place any time, and place, with anyone, in a multitude of ways, and without permission. Furthermore, it is unrealistic to pretend that we can in any way nearly precisely measure what has been learned and how well. Teachers can not control access to information and can no longer be seen as the gatekeeper of learning (Lynch 1991,64). Much of the entire educational system is designed to teach students to do things the one right way as defined by the authority figure/teacher. We are taught to recite what we hear or read without critically interacting with the information as it moves in and out of short-term memory. In this exchange, the information leaves no tracks, and independent thinking skills are not developed. By the time the person finishes high school he or she will have taken over 8,500 test, quizzes, and exams....thus, the one right answer approach becomes deeply ingrained in our thinking(Von Oech 1983, p. 21). This may be fine for some mathematical problems where there is in fact only one right answer. The difficulty is that most of life does not present itself in this manner. Life is ambiguous; there are many right answers, all depending on what you are looking for .

As we leave the twentieth century there will need to be a paradigm shift in education's basic emphasis. "Our current educational system evolved to produce workers for the Industrial Revolution's factory-based economy, for work that requires patience, docility, and the ability to endure boredom. Students learned to sit in orderly rows, to absorb by rote, and to move as a group through the material regardless of individual differences in learning speed"(Clarke 1986, p.76). As we prepare students for the twenty-first century, we must give them certain key intellectual skills: analytical thinking, critical thinking, the ability to make judgments, to reason quantitatively, to balance opposing points of view. Schools must focus more on teaching students how to learn, and how to think. Marilyn Ferguson (1980, p. 228) describes this new paradigm of education, as one which "looks to the nature of learning rather than the methods of instruction. Learning, after all.... is the process by which we have moved every step of the way since we first breathed; the transformation that occurs in the brain whenever new information is integrated, whenever a new skill is mastered. Learning is kindled in the mind of the individual. Anything else is mere schooling."

Tech-Prep and School-To-Work

Over the past eight years, U.S. policy-makers have become attracted to a different type of educational learning system that provides students with the skills necessary to become productive parts of a quality workforce that can meet the rigorous standards of a global economy. This new mission for education was unveiled by President George Bush in January 1990, when he stated the six National Goals for Education. "By the year 2000.... every school in America will ensure that all students....be prepared for responsible citizenship, further learning, and productive employment." This clearly focuses education on not only preparing a student academically, but also for further learning and being able to take up productive employment. Being academically prepared and not being employable does not do the individual or the nation any good (Hoerner,1991).

The new mission for education as we head into the 21st Century is clearly to prepare all students for further learning and productive employment. We must provide the same opportunities to all students, not just the traditional 20-30 percent identified as college bound. The patchwork fix-it reform jobs have not worked previously, and there is nothing to indicate that they will in the future. Total educational reform has to come about in every American school to prepare our future and our students to compete in an ever more technically oriented global economy(Beaumont 1995 p.1). Tech Prep, and School to Work, have been referred to as the most exciting initiatives in education in decades. Tech Prep and School to Work are articulated educational programs that consist of two years of secondary and two years of higher education, or an apprenticeship program of at least two years following secondary instruction with a common core of required proficiency in mathematics, science, communications, and technologies designed to lead to an associate degree or certificate in a specific career field and leads to effective employment placement or transfer of students to a four year baccalaureate degree.

If Tech-Prep programs are to be successful, then the six SCANs recommendations must be incorporated:

- Tech-Prep programs will demonstrate systemic change at both the secondary and post-secondary level.
- Tech-Prep programs will attract those students who are neither in college prep or vocational programs and will provide expanded opportunities for students in traditional college prep or vocational programs.
- Tech-Prep programs must demonstrate a partnership between secondary education, post-secondary education, and business/industry and labor.
- Tech-Prep programs must prepare graduates with the advanced skills necessary for technical occupations.

- Tech-Prep programs must develop in students the academic, occupational, and employability competencies at both secondary and post-secondary levels that enable employment.
- Tech-Prep programs include early career exploration, starting with the individualized career plan in the ninth grade, and establish a Tech-Prep path that arranges the study of mathematics, science, communications, technology, and specific technical skills in a step-by-step progression of coordinated curricula that articulates academic skills with employment skills (Lankard, 1995).

For Tech-Prep reform to improve secondary education, schools must provide all students with the skills they will need to be successful in the world of work by providing a curriculum that is both rigorous and relevant to a technological information-based society. Classes must require students to apply math, science, and language arts skills in real world contexts. Students must be equipped with skills needed to be employable in a variety of positions.

Applied Academics

The purpose of a teacher is not primarily to counsel, interpret, instruct, or in any way lead people to believe that the teacher is the sole supplier of the answers to their questions. Instead, the teacher is a facilitator of learning and in this context he or she serves as a resource of knowledge and experience that others can draw on to solve problems and develop the potential of others...(Applied Academics Teacher's Guide, 1995).

Applied Academics curriculum was established principally to serve general education students who do not initially plan to pursue a four-year college degree. That is to say, most of these students will find jobs in the workforce immediately following high school or they may continue their education in a two-year post-secondary program.

An Applied Academics curriculum was developed by CORD (Center for Occupational Research and Development). The curriculum attempted to develop and integrate the application of math and science concepts to the real world while still providing the academic objectives required by state and federal mandates and college entrance requirements (Pepple and O'Connor, 1992).

The curricula used in most traditional schools does not emphasize or suggest any application where the student might apply the specific concepts being taught (Brown, 1989). Wilson (1994) believed that the learning environment's major component should be problem-solving systems and that practical thinking should go beyond context material. Wilson stated that this type of applied learning parallels vocational education in that memorization is limited and practical experience is the motivator for student success.

Beadles (1992) participated in a pilot program which used the Applied Biology and Chemistry curriculum developed by the Center for Occupational Research and Development. Data was collected via a pre- and post-test to assess the success of the students and their attitude regarding science. The study collected data from students who were taught in a non-traditional format, i.e. cooperative learning, and using the Applied Biology and Chemistry curriculum. The experimental group was compared to a control group which consisted of students who were taught with a traditional instructional method, i.e. lectures using contextual material.

The research showed that there was no significant difference in the mean gain scores or in the attitudes of students being taught by the Applied Academic method as compared to the students being taught by the traditional method of instruction and curriculum. The researcher did observe a greater enthusiasm for the concepts being taught when being presented through applied instruction. It is believed that enthusiasm will create a "greater appreciation and understanding of science and technology as it is used in the real world today" (Beadles, 1992, p. 70). Beadles' conclusion stated that it is the duty of the educational system to present instructors and materials that will provide enthusiasm and quality programs in science technology, thereby creating a "catalyst for the successful workforce development in the 21st century" (p. 70).

Related Research

This section of the review of literature provides an overview of research studies related to applied academic curricula. Specifically, nine comprehensive studies relating to this research are detailed in the following text. Dugger and Johnson (1989) conducted a study at Iowa State University of the Principles of Technology (PT) curriculum. The curriculum used was developed by CORD and was designed to teach basic physics concepts through an applied approach.

This was a two-year study designed to compare students' performance in traditional physics classes with that of students taking Principles of Technology. The scope of the study included 675 students in fifteen Iowa school districts. All students were giving a standardized examination taken as a pre-test and post-test. The study found that students enrolled in the Principles of Technology courses posted gain scores that were, on average, 141 per cent higher than those students enrolled in traditional physics.

Two other studies were found that compared Principles of Technology (applied physics) and traditional physics. One study was done in Alabama (Baker, 1990) and the other in Oklahoma (Christian, 1993). Both studies found no significant difference in student gain between the applied (PT) instructional approach and the traditional methods of teaching physics. Christian (1993) concluded from the data that the applied curriculum seized a student clientele who otherwise would not have taken a course in physics and these students achieved learning of physics fundamentals approximately equal to students provided traditional physics instruction.

Five different studies were found that compared traditional biology to Applied Biology/Chemistry classes that used the ABC curriculum written by CORD. All five studies found no significant differences in terms of student achievement, but all five studies made recommendations that were favorable to the teaching of Applied Biology/Chemistry and the use of ABC curriculum written by CORD. Beadles (1992) recommended the ABC curriculum be used in all Applied Biology/Chemistry courses and that ABC courses be accepted as an equivalent substitute for traditional biology in meeting high school graduation and college entrance requirements. Key and Lee-Cooper (1994) recommended that administrators consider the needs of the students when determining curriculum assignment. Miles-Wilson (1994) found that ABC students possessed significantly higher attitudes toward science and the environment than their traditional counterparts. Houdis (1994) concluded that when comparing students who previously performed in the bottom half of their peer group in math and reading, that after using the ABC Biology curriculum actually had significantly higher academic achievement than their traditional biology counterparts.

The final study reviewed was Hamby (1995) where he collected data from four Oklahoma high schools where both traditional and applied biology courses were offered. The study concluded that there was no significant difference between the curricula in terms of student achievement and attitude toward science and the environment. Hamby (1995) did make three important recommendations:

1. Students should receive identical recognition for successful completion of either ABC Biology or traditional biology in efforts to fulfill high school graduation or college entrance requirements.

2. Students should be offered either ABC Biology or traditional biology. The presence of alternatives provide for matching of learning styles to teaching approaches.

3. Teachers should be provided in-service training focused on effectively utilizing applied curricula and alternative instruction approaches. An increased store of teaching skills and materials will undoubtedly elevate the quality of teacher instruction.

Summary

Research has indicated that a change in the educational paradigm is critical to the educational reform movement. Today in Classroom of Quality, a new process-oriented paradigm of continuous learning and improvement, is beginning to replace the old Tayloresque, product-oriented, fear-driven paradigm of teaching and testing.(Bonstingl, 1992, p.34).

While many traditional schools and teachers still view learning as a collection of linear, consecutive segments of one-way communication, Schools and Classrooms of Quality view the learning process as a spiral, with students' and teachers' energies directed toward unlimited continuous improvement, similar to Juran's Spiral of Progress in Quality (Juran, 1988)—Perception - Conceptualization -Thought -Action -Reaction. In this view of continuous learning rather than serving as silent tabular rasae or empty vessels to be filled by teachers, texts and tests, students use their prior knowledge and understanding as the foundation for construction of new learning and the constant refinement of developing intelligences—thus the birth of Applied Academics. This instruction method allows students to better use past experiences to realize the importance and relevance of their learning experience (Hamby, 1995).

Research studies have shown that applied academic coursework when taught by an effective, motivated teacher that is more like a group guide or enabler that provides and sets up the learning experiences and encourages the students to experiment, question, observe, and manipulate the environment at their own pace in their own way, better prepares students for the real world of work and at the very least is a viable alternative to the traditional teaching of the curriculum.

CHAPTER III

METHODOLOGY

Purpose

The purpose of this study was to determine participants' assessment of inservice training workshops for teaching the Applications in Biology/Chemistry curriculum in terms of the extent to which selected outcomes were and should have been accomplished.

Objectives

To accomplish the purpose of the study, a set of specific objectives were formulated and are listed below. The study sought to determine the extent to which participants felt the workshops did and should have accomplished the following:

1. prepare you to teach a course in ABC for high school credit.

2. Introduce the CORD ABC materials and explain how to use them in a high school class for science credit.

3. Provide examples for time lines and structure of curriculum for a stand-alone course.

4. Explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry.

5. Explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students.

6. Provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom.

7. Define cooperative learning and give examples of ways to utilize it in the classroom.

8. Discuss the challenges of using cooperative learning groups, strategies for grouping students and the structure of cooperative learning activities.

9. Explain the use of the job profiles included in the CORD curriculum.

10. Explain the use of the student activities included in the CORD curriculum.

11. Explain the use of the Activities by Occupational Area in the CORD curriculum.

12. Explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities.

13. Provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies.

14. Explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems.

15. Explain that ABC is a contextual approach to teaching laboratory science skills.

16. Explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work.

17. Provide realistic and useful fieldtrips for any community.

18. The final objective is to develop a uniform set of guidelines for Applications in Biology/Chemistry workshops that could be used for certification by the State Department of Vocational and Technical Education.

Hypothesis

Listed below is the hypothesis which was constructed to achieve the objectives of the study:

Ho1- There is no significant difference between the expected satisfaction and the actual satisfaction of the teachers who attended the different workshops in this study.

Hypothesis Testing

A t-test analysis was used to determine whether significant differences existed between the expected outcome and the actual outcome for each of the seventeen questions ask of the respondents, and their scores were combined into four instructor groups. An alpha level of α=.05 was used to determine statistical significance. The t-test was used to determine just how great the difference between two or more means must be for it to be judged significant, that is a significant departure from differences, which might be expected from chance alone. Another way of stating the function of the t-test is to assert that through its use, we test the null hypothesis that the four groups means are not significantly different, that is, the means are so similar that the same groups can be considered to have been drawn from the same population(Popham 1973, pg.125).

Institutional Review Board

Federal regulations and Oklahoma State University policy require review and approval of all research studies that involve human subjects before investigators can initiate their research. The office of University Research at Oklahoma State University and the Institutional Review Board conduct the aforementioned review to protect the rights and welfare of human subjects involved in biomedical and behavioral research. In compliance with this policy, this study received the proper surveillance and was granted permission to continue. The Institutional Review Board approval was AG- 96-009 (See Appendix A).

Scope

The scope of the study consisted of the respondents to a survey sent to the teacher participants of 11 inservice workshops for the Applied Biology/ Chemistry curriculum developed by CORD as the main instruction material. Four different instructors held workshops in Oklahoma that were sanctioned by the State Department of Vocational Education, which certified teachers of Applied Biology/Chemistry classes for high school credit as a laboratory science requirement.

The four instructors held eleven workshops that had one hundred and sixty-one people attending. Fifty-five of the students attending the workshops said they did not intend to teach an Applied Biology/Chemistry course for high school credit. One hundred and six surveys were sent to teachers who attended the workshops. Sixty-two

(58%) teachers returned the questionnaire indicating they were or had taught Applied Biology/Chemistry classes for high school credit.

The Workshops

Group 1 presented seven workshops. Each workshop was team taught and included graduate students, agriculture education teachers, and science teachers. They were ten days in duration and had an all day format including actual field trips and cooperative learning modules. Surveys were not sent to participants of this group that were identified as graduate students or agriculture education teachers. A total of seventy-three surveys were sent and thirty-nine (53%) teachers responded and one teacher returned a survey that was left blank, stating he did not wish to participate in the study.

Group 2 consisted of two workshops. The workshops were offered at a regional university for college credit. The duration of the workshops was ten consecutive days with eight hours of daily instruction. Surveys were not sent to participants of this group that were undergraduate students or those who indicated that they were not science teachers. A total of sixteen surveys were sent and 7 (44%) teachers responded.

Group 3 was part of a school-to-work consortium that paid a stipend and was held in the summer to train future applied biology/chemistry teachers for the consortium's schools. The duration of the workshops was ten consecutive days with eight hours of daily instruction. All participants were science teachers. A total of seven surveys were sent and 5 (71%) teachers responded.

Group 4 was part of a workshop presented for a school-to-work consortium. All participants were employed by the consortium and were teaching applied biology/chemistry at the time of the workshop. The workshops were held during the school year and were three two-day sessions in length. Each session was at least a month apart. A total of ten surveys were sent and 9 (90%) teachers responded and one teacher left the survey blank and indicated she did not wish to respond to the survey. The surveys were handed out at the completion of the workshop by the instructor, and participants completed the survey and returned it before being dismissed from the workshop.

Questionnaire/Measuring Instrument

A questionnaire was developed to measure the degree of satisfaction with the attended workshop as compared to the expected satisfaction of the respondents. The questionnaire was made up of seventeen questions that related to the needs of teachers of Applications of Biology/Chemistry and the proper use of the Biology/Chemistry curriculum written by the Center for Occupational Research and Development. The respondents were asked to rate their satisfaction with the workshop on a continuous scale from 1 (low) to 7 (high) on each of the seventeen questions. Respondents were also asked to design an Application of Biology/Chemistry workshop that would meet the needs of the teachers and encourage attendance. This was measured by the same seventeen questions previously mentioned above and eight questions that dealt with the physical structure and timing of a workshop.

Analysis Procedure

This study compared four groups of ABC workshop participants. Each of the four groups was instructed by a different person and with a different syllabus for each workshop, but all workshops were intended to prepare teacher to instruct a class for high school credit in Applied Biology/Chemistry using the curriculum written by the Center for Occupation Research and Development. The quantitative comparison of the groups was done from their responses to the questionnaire. Since this study was made up of four groups in each situation, the t-test for paired two samples for means was used to test for significant differences between the group means. The significant level of .05 was used as the level for acceptance or rejection of each of the seventeen questions. The t-test was calculated using the Microsoft Excel statistical software for microcomputers.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Purpose

The purpose of this study was to determine participants' assessment of inservice training workshops for teaching the Applications in Biology/Chemistry curriculum in terms of the extent to which selected outcomes were and should have been accomplished.

Findings of the Study

The following section was included to present analysis of the data collected relative to the objectives of this study. Each of the seventeen questions asked of the participants of four different ABC workshops groups was statistically analyzed using a t-test to determine whether significant differences existed for each of the four groups and if there was a significant differences in the total means of all respondents. The respondents were asked to rate their satisfaction with the workshops on a continuous scale from 1 (Low) to 7 (High) on each of the seventeen questions.

Tables

Table I was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 EXTENT ACCOMPLISHED mean 5.86 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.46 (α=.001) and the Total EXTENT ACCOMPLISHED mean 5.78 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.40 (α=.000007).

TABLE I

ANALYSIS OF QUESTION 1:
ASSESSMENTS OF WORKSHOPS RELATIVE TO PREPARATION
TO TEACH APPLIED BIOLOGY/CHEMISTRY FOR HIGH SCHOOL CREDIT

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	5.86/1.46	6.46/1.07	2.02	.001 **
Group 2	7	5.71/1.25	6.14/0.89	2.44	.481
Group 3	5	5.00/0	5.80/0.83	2.77	.099
Group 4	9	6.00/1.00	6.66/0.50	2.30	.080
Total	60	5.78/1.31	6.40/0.97	2.00	.000007 **

*Significant beyond .05 level **Significant beyond .01 level

Table II was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 EXTENT ACCOMPLISHED mean 6.15 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.61(α=.01) and the Total EXTENT ACCOMPLISHED mean 6.06 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.46 (α=.002).

TABLE II

ANALYSIS OF QUESTION 2:
ASSESSMENTS OF WORKSHOPS RELATIVE TO INTRODUCTION OF CORD ABC MATERIALS AND EXPLANATION OF USE IN HIGH SCHOOL CLASS

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	6.15/1.24	6.61/0.74	2.02	.01 **
Group 2	7	5.71/1.38	6.00/1.15	2.44	0.17
Group 3	5	5.00/1.22	5.60/1.34	2.77	0.20
Group 4	9	6.55/0.72	6.66/0.70	2.30	0.34
Total	60	6.06/1.23	6.46/0.89	2.00	.002 **

*Significant beyond .05 level **Significant beyond .01 level

Table III was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only groups where the difference was significant is Group 1(α=.006),Group 2 (α=.047) and the Total EXTENT ACCOMPLISHED mean 5.08 and EXTENT SHOULD HAVE ACCOMPLISHED mean 5.95 (α=.0005).

TABLE III

ANALYSIS OF QUESTION 3:
ASSESSMENTS OF WORKSHOPS RELATIVE TO PROVIDING EXAMPLES FOR TIME LINES AND STRUCTURE OF CURRICULUM FOR STAND-ALONE COURSE

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.02/1.85	6.02/1.47	2.02	.006 **
Group 2	7	4.71/1.38	5.85/1.06	2.44	0.047 *
Group 3	5	5.20/0.83	5.40/1.14	2.77	0.37
Group 4	9	5.55/1.33	6.00/0.78	2.30	0.10
Total	60	5.08/1.66	5.95/1.33	2.00	.0005 **

*Significant beyond .05 level **Significant beyond .01 level

Table IV was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.001), Group 4 (α=.04) and the Total EXTENT ACCOMPLISHED mean 5.00 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.05 (α=.0000039).

TABLE IV

ANALYSIS OF QUESTION 4:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING HOW THE CORD CURRICULUM WOULD MEET THE P.A.S.S. OBJECTIVES AND THE LEARNER OUTCOMES FOR COLLEGE ENTRY

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.10/2.04	6.25/1.14	2.02	.001 **
Group 2	7	4.71/2.36	5.71/2.13	2.44	0.13
Group 3	5	4.00/0.00	4.60/0.54	2.77	0.07
Group 4	9	5.11/1.16	6.22/0.66	2.30	0.04 *
Total	59	5.00/1.88	6.05/1.27	2.00	.0000039 **

*Significant beyond .05 level **Significant beyond .01 level

Table V was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores.

TABLE V

ANALYSIS OF QUESTION 5:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE DIFFERENT TYPES OF LEARNING STYLES AND HOW TO USE DIFFERENT TEACHING STYLES TO MAKE THE CURRICULUM MORE INCLUSIVE FOR ALL STUDENTS

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.35/1.78	5.76/1.54	2.02	.021
Group 2	7	4.42/1.98	5.28/1.79	2.44	0.17
Group 3	5	4.00/1.22	4.40/1.14	2.77	0.17
Group 4	9	6.22/0.97	6.22/0.66	2.30	1.00
Total	60	5.26/1.74	5.66/1.49	2.00	0.07

*Significant beyond .05 level **Significant beyond .01 level

Table VI was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 EXTENT ACCOMPLISHED mean 5.25 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.05(α=.006) and the Total EXTENT ACCOMPLISHED mean 5.40 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.05 (α=.001).

TABLE VI

ANALYSIS OF QUESTION 6:
ASSESSMENTS OF WORKSHOPS RELATIVE TOPROVIDING EXAMPLES OF DIFFERENT WAYS FOR TEACHERS TO MODEL IMPORTANT SCIENCE AND EMPHASIZE THE IMPORTANCE OF MODELING SKILLS IN THE CLASSROOM

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	5.25/1.71	6.05/1.31	2.02	.006 **
Group 2	7	5.57/1.71	6.42/0.78	2.44	0.22
Group 3	5	4.40/0.54	4.60/0.54	2.77	0.37
Group 4	9	6.44/1.01	6.55/0.52	2.30	0.68
Total	60	5.40/1.61	6.05/1.21	2.00	.001 **

*Significant beyond .05 level **Significant beyond .01 level

Table VII was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores.

TABLE VII

ANALYSIS OF QUESTION 7:
ASSESSMENTS OF WORKSHOPS RELATIVE TO DEFINING COOPERATIVE GROUPS, STRATEGIES FOR GROUPING STUDENTS AND STRUCTURE OF COOPERATIVE LEARNING ACTIVITES

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	6.15/1.53	6.25/1.59	2.02	0.86
Group 2	7	5.71/1.97	5.57/1.81	2.44	0.82
Group 3	5	5.40/0.47	4.60/0.54	2.77	0.09
Group 4	9	6.11/1.05	6.33/0.86	2.30	0.51
Total	59	6.03/1.46	6.01/1.52	2.00	.0.94

*Significant beyond .05 level **Significant beyond .01 level

Table VIII was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores, group 3 did feel that the workshop training did exceed their expectations.

TABLE VIII

ANALYSIS OF QUESTION 8:
ASSESSMENTS OF WORKSHOPS RELATIVE TO DISCUSSING THE CHALLENGES OF USING COOPERATIVE LEARNING GROUPS, STRATEGIES FOR GROUPING STUDENTS AND STRUCTURE OF COOPERATIVE LEARNING ACTIVITIES

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.64/1.51	6.10/1.44	2.02	0.14
Group 2	7	5.14/2.11	5.57/2.14	2.44	0.50
Group 3	5	5.60/0.54	4.60/0.54	2.77	0.08
Group 4	9	5.88/1.05	6.00/0.78	2.30	0.34
Total	59	5.58/1.60	5.86/1.62	2.00	0.22

*Significant beyond .05 level **Significant beyond .01 level

Table IX was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.0003) and the Total (α=.0003), and <u>group 4 did feel that the workshop training did exceed their expectations.</u>

TABLE IX

ANALYSIS OF QUESTION 9:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE USE OF JOB PROFILES INCLUDED IN THE CORD CURRICULUM

<u>PARTICIPANT RATINGS</u>

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	4.89/1.99	6.10/1.20	2.02	.0003 **
Group 2	7	5.57/1.98	6.00/1.29	2.44	0.35
Group 3	5	4.60/1.51	5.00/1.22	2.77	0.47
Group 4	9	6.11/0.78	6.00/0.86	2.30	0.72
Total	60	5.13/1.85	5.98/1.18	2.00	.0003 **

*Significant beyond .05 level **Significant beyond .01 level

Table X was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.03) and the Total (α=.01), and group 4 did feel that the workshop training and their expectations were equal.

TABLE X

ANALYSIS OF QUESTION 10:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE USE OF THE STUDENT ACTIVITIES INCLUDED IN THE CORD CURRICULUM

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	5.71/1.53	6.30/1.19	2.02	.03 *
Group 2	7	6.14/1.46	6.28/0.75	2.44	0.73
Group 3	5	4.80/0.83	5.80/0.83	2.77	0.14
Group 4	9	6.55/0.72	6.55/0.72	2.30	1.00
Total	60	5.81/1.43	6.30/1.06	2.00	.01 **

*Significant beyond .05 level **Significant beyond .01 level

Table XI was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.006) and the Total (α=.0006), and group 4 did feel that the workshop training and their expectations were equal.

TABLE XI

ANALYSIS OF QUESTION 11:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE USE OF THE ACTIVITIES BY OCCUPATIONAL AREA IN THE CORD CURRICULUM

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	5.12/1.76	6.05/1.35	2.02	.006 **
Group 2	7	3.85/2.34	5.28/1.38	2.44	0.07
Group 3	5	4.60/0.89	5.20/1.09	2.77	0.20
Group 4	9	6.44/1.01	6.44/0.52	2.30	1.00
Total	60	5.13/1.77	5.95/1.28	2.00	.0006 **

*Significant beyond .05 level **Significant beyond .01 level

Table XII was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.0004) and the Total (α=.001), group 2 did feel that the workshop training exceeded their expectations.

TABLE XII

ANALYSIS OF QUESTION 12:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE USE OF THE LABORATORY ACTIVITIES AND INCLUDED EQUIPMENT, LAB PREPARATION GUIDE, SAMPLE DATA AND SOLUTIONS TO QUESTIONS AND OPTIONAL EXTENSIONS OF THE LAB ACTIVITIES

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.48/1.87	6.58/0.90	2.02	.0004 **
Group 2	7	6.42/0.78	6.00/1.15	2.44	0.40
Group 3	5	5.60/0.89	6.00/1.00	2.77	0.47
Group 4	9	6.88/0.33	7.00/0.00	2.30	0.34
Total	60	5.81/1.64	6.53/0.91	2.00	.001 **

*Significant beyond .05 level **Significant beyond .01 level

Table XIII was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores; group 2 did feel that the workshop training did exceed their expectations, and group 4 felt the workshop met expectations.

TABLE XIII

ANALYSIS OF QUESTION 13:
ASSESSMENTS OF WORKSHOPS RELATIVE TO PROVIDING INFORMATION ON THE CURRICULUM AND POSSIBLE VENDORS OF EQUIPMENT AND SUPPLIES

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	5.94/1.39	6.46/1.04	2.02	0.06
Group 2	7	6.28/1.11	5.85/1.86	2.44	0.53
Group 3	5	5.40/0.54	6.40/0.54	2.77	0.08
Group 4	9	6.88/0.33	6.88/0.33	2.30	0.00
Total	60	6.08/1.25	6.45/1.08	2.00	0.06

*Significant beyond .05 level **Significant beyond .01 level

Table XIV was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant was Group 1 EXTENT ACCOMPLISHED mean 5.82 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.20(α=.05) and the Total EXTENT ACCOMPLISHED mean 5.51 and EXTENT SHOULD HAVE ACCOMPLISHED mean 6.01 (α=.003).

TABLE XIV

ANALYSIS OF QUESTION 14:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THE USE OF THE CORD VIDEOS AND GIVING SUGGESTED QUESTIONS FOR DISCUSSION AND OUTLINING POSSIBLE SOLUTIONS TO PROBLEMS

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	5.82/1.46	6.20/1.17	2.02	0.05 *
Group 2	7	4.42/1.71	5.28/1.49	2.44	0.11
Group 3	5	5.40/0.54	5.60/1.14	2.77	0.70
Group 4	9	5.22/1.92	5.88/1.61	2.30	0.80
Total	60	5.51/1.59	6.01/1.32	2.00	.003 **

*Significant beyond .05 level **Significant beyond .01 level

Table XV was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores, groups 2 and 4 did feel that the workshop training did exceed their expectations.

TABLE XV

ANALYSIS OF QUESTION 15:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THAT ABC IS A CONTEXTUAL APPROACH TO TEACHING LABORATORY SCIENCE SKILLS

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P $(T<=\tau)$
Group 1	39	5.89/1.25	6.20/1.19	2.02	0.23
Group 2	7	6.57/0.53	5.71/1.79	2.44	0.30
Group 3	5	5.00/0.70	5.60/0.54	2.77	0.20
Group 4	9	6.66/0.50	6.55/0.72	2.30	0.34
Total	60	6.01/1.14	6.15/1.19	2.00	0.49

*Significant beyond .05 level **Significant beyond .01 level

Table XVI was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops. While there is noticeable difference in the scores, the t-test revealed that the only group where the difference was significant is Group 1 (α=.03), and group 4 did feel that the workshop training did exceed their expectations.

TABLE XVI

ANALYSIS OF QUESTION 16:
ASSESSMENTS OF WORKSHOPS RELATIVE TO EXPLAINING THAT SCIENCE CONCEPTS PRESENTED IN ABC SHOULD BE TAUGHT RELATIVE TO LIFE, HOME, SOCIETY, AND THE WORLD OF WORK

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P ($T<=\tau$)
Group 1	39	6.05/1.52	6.56/0.71	2.02	0.03 *
Group 2	7	6.71/0.48	6.28/1.49	2.44	0.35
Group 3	5	5.00/0.00	5.80/0.83	2.77	0.09
Group 4	9	6.88/0.33	6.66/0.50	2.30	0.16
Total	60	6.16/1.32	6.48/0.83	2.00	0.07

*Significant beyond .05 level **Significant beyond .01 level

Table XVII was designed to report the comparison of the groups' mean score differences on workshop satisfaction vs. workshop expectation, and to allow for comparison of the total means relative to the importance of the question to the respondents and the importance of the question to the development of future workshops.

While there is noticeable difference in the scores, the t-test revealed that there was no significant difference in the groups and total means scores, <u>group 2 did feel that the workshop training did exceed their expectations.</u>

TABLE XVII

ANALYSIS OF QUESTION 17:
ASSESSMENTS OF WORKSHOPS RELATIVE TO PROVIDING REALISTIC AND USEFUL FIELD-TRIPS FOR ANY COMMUNITY

PARTICIPANT RATINGS

	N=	EXTENT ACCOMPLISHED MEAN/S.D.	EXTENT SHOULD HAVE ACCOMPLISHED MEAN/S.D.	T-VALUE TWO-TAIL	P (T<=τ)
Group 1	39	6.02/1.49	6.20/1.39	2.02	0.59
Group 2	7	5.71/0.75	5.42/1.51	2.44	0.60
Group 3	5	4.60/2.07	5.20/2.38	2.77	0.07
Group 4	9	5.33/1.11	5.66/1.41	2.30	0.34
Total	60	5.76/1.46	5.95/1.51	2.00	0.42

*Significant beyond .05 level **Significant beyond .01 level

CHARTS

The following section was included to present analysis of the data collected relative to the questions on the design of future workshops that would meet the needs of future teachers and that would encourage teacher attendance.

Chart 1

Chart 1 was designed to report the group's preference on the length of the ideal workshop (Survey Question #18). All sixty respondents were grouped together for analysis.

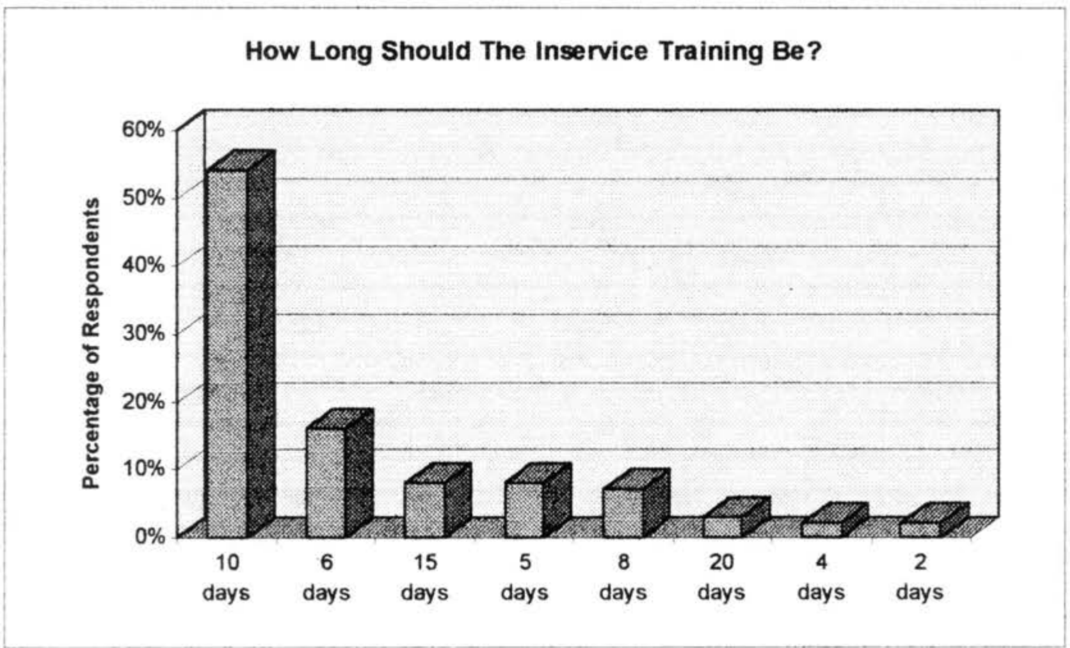

Chart 1

This chart shows the percentile responses of the respondents. 32 of the 60 or 54% of the respondents felt that the workshop should be 10 days in length, 10 of the 60 or 16% of the respondents stated that their would prefer that the workshop be three, two day sessions. 5 respondents preferred 15 days, 5 respondents preferred 5 days, 4 respondents preferred 8 days, 1 respondent preferred a 4 day, and 1 respondent marked a 2 day workshop.

Chart 2

Chart 2 was designed to report the group's preference on how the days should be scheduled in the ideal workshop (Survey Question #19). All of the sixty respondents were grouped together for analysis.

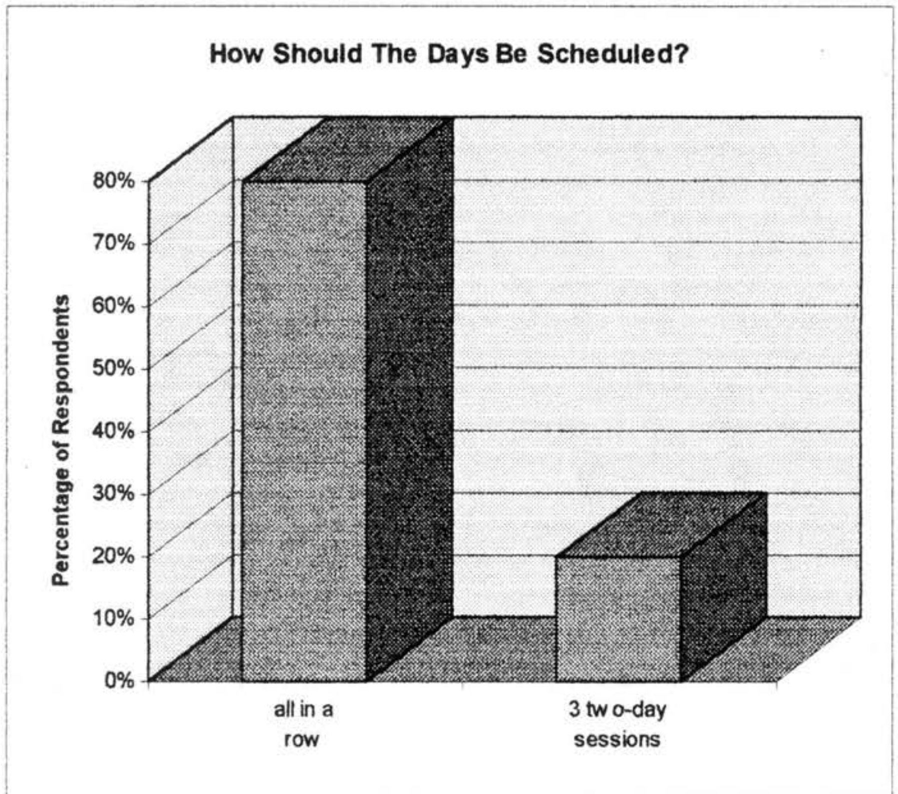

Chart 2

This chart shows the percentile responses of the respondents. 48 of the 60 or 80% of the respondents felt that the ideal workshop would meet for a complete week, Monday through Friday, and 12 of the 60 or 20% of the respondents preferred the workshop in 3 or more 2-day (Friday, Saturday) sessions. Note that 7 of these 12 respondents came of group four, which was in a (3) 2-day sessions workshop.

Chart 3

Chart 3 was designed to report the group's preference on the number of hours per a day of instruction the ideal workshop would have (Survey Question #20). All of the sixty respondents were grouped together for analysis.

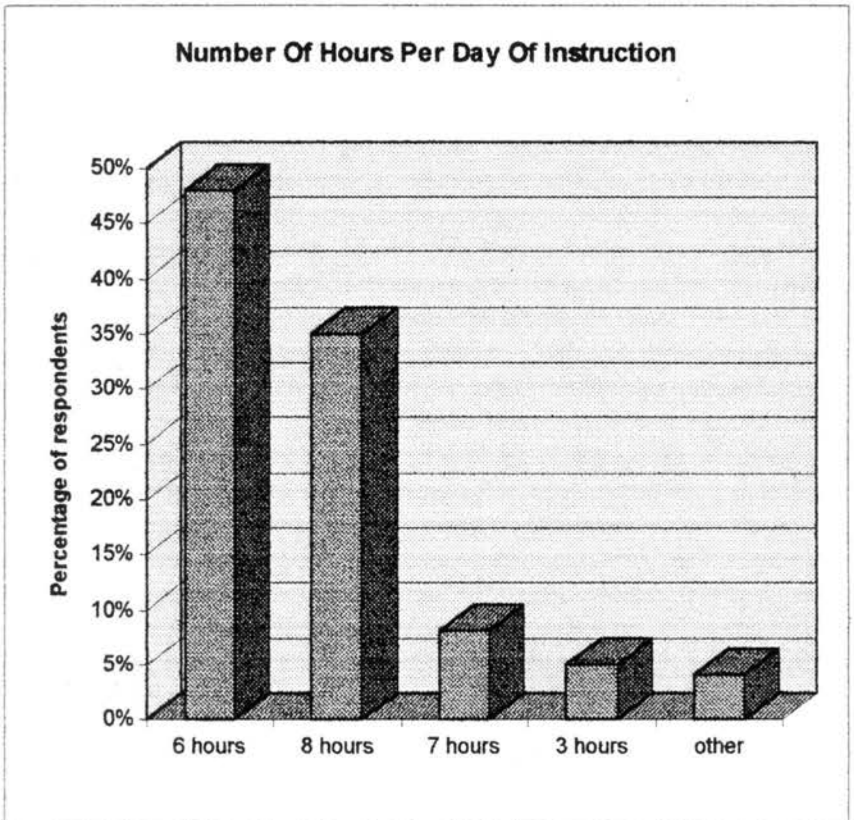

Chart 3

This chart shows the percentile responses of the respondents. 29 of the 60, or 48% of the respondents felt that the ideal workshop would meet for 6 hours a day; 21 of the 60, or 35% of the respondents preferred an 8 hour day; 5 of the 60, or 8% of the respondents chose 7 hour days; 3 respondents picked 5 hour days; 1 respondent said that 4 hours was long enough and 1 respondent preferred to attend for 10 hours each day.

Chart 4

Chart 4 was designed to report the group's preference on what are the best days of the week for the ideal workshop (Survey Question #21). All of the sixty respondents were grouped together for analysis.

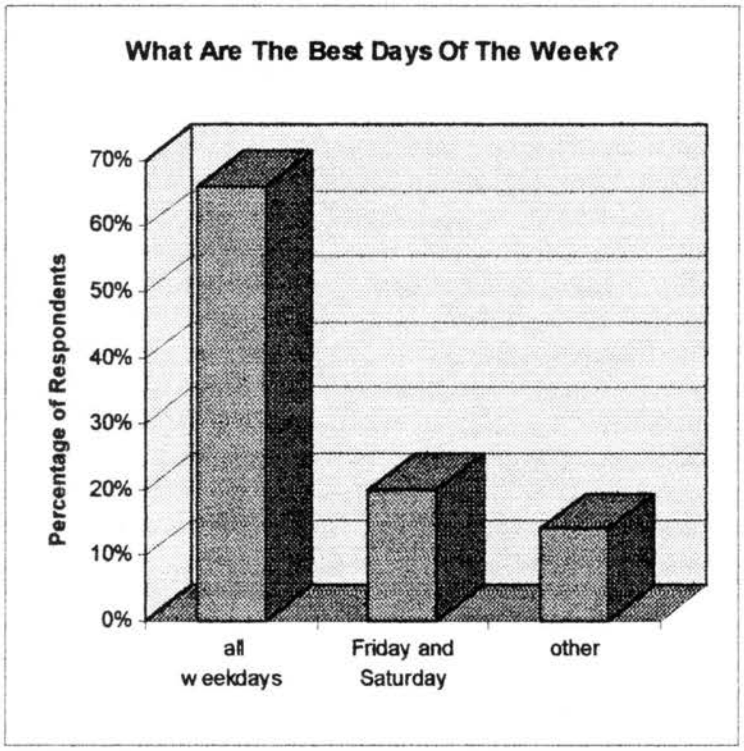

Chart 4

This chart shows the percentile responses of the respondents. 40 of the 60 or 66% of the respondents felt that the ideal workshop would meet for a complete week, Monday through Friday, and 12 of the 60 or 20% of the respondents preferred that the workshop be a 2-day Friday and Saturday session. Note that 7 of these 12 respondents came of group four, which was in a 2-day Friday, Saturday session workshop. Eight of the 60 or 14% of the respondents chose some arrangement different than the two listed.

Chart 5

Chart 5 was designed to report the group's preference on what are the best months of the year for the ideal workshop (Survey Question #22). All of the sixty respondents were grouped together for analysis.

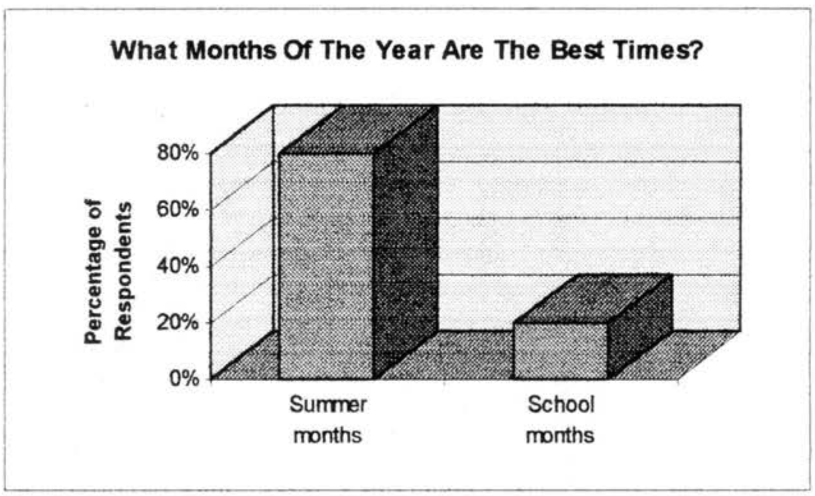

Chart 5

This chart shows the percentile responses of the respondents. 48 of the 60 or 80% of the respondents felt that the ideal workshop would meet during the summer, and 12 of the 60 or 20% of the respondents preferred that the workshop was held during the school year. Note that 8 of these 12 respondents came of group four, which was in a (3) 2-day sessions workshop. Eight of the 60 or 14% of the respondents chose some arrangement different than the two listed.

Chart 6

Chart 6 was designed to report the group's preference on if a follow up session should be offered one year after the workshop to help with any difficulties that teachers may have (Survey Question #23). All of the sixty respondents were grouped together for analysis.

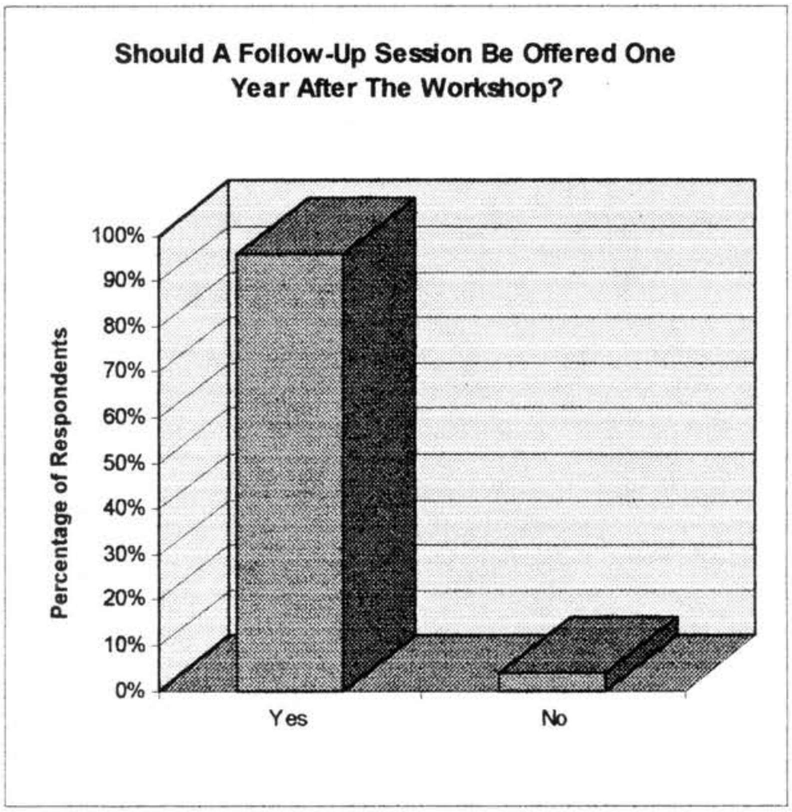

Chart 6

This chart shows the percentile responses of the respondents. 58 of the 60 or 96% of the respondents felt that the ideal workshop would offer a follow up session one after the first workshop, and 2 of the 60 or 4% of the respondents preferred that the workshop did not offer a follow up session one year after the first workshop.

Chart 7

Chart 7 was designed to report the group's preference on whether college credit should be offered for the ideal workshop (Survey Question #24). All of the sixty respondents were grouped together for analysis.

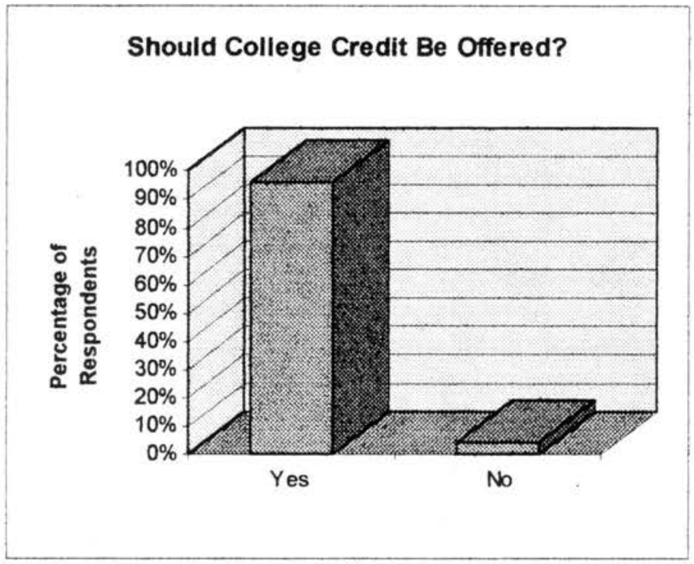

Chart 7

This chart shows the percentile responses of the respondents. 58 of the 60 or 96% of the respondents felt that the ideal workshop would offer college credit , and 2 of the 60 or 4% of the respondents did not feel that college credit was important to the workshop.

Chart 8

Chart 8 was designed to report the group's preference on the need for a stipend to be paid for attendance of the workshop (Survey Question #25). All of the sixty respondents were grouped together for analysis.

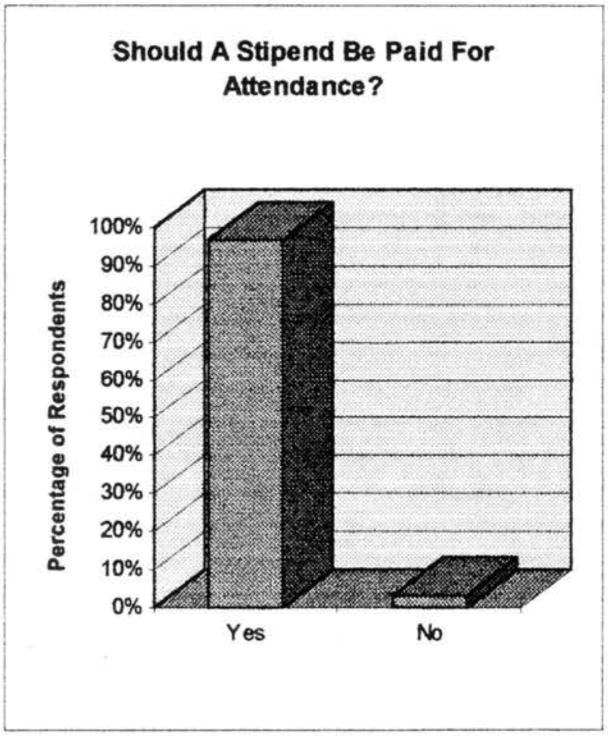

Chart 8

This chart shows the percentile responses of the respondents. 56 of the 60 or 94% of the respondents felt that the ideal workshop would offer a stipend for attendance, and 4 of the 60 or 6% of the respondents did not feel that a stipend was important to the workshop.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

Summary

As high schools try to increase the enrollment in science classes and require more laboratory science credits for graduation and with universities raising the number of laboratory science credits to three for college entrance, many high schools have added Applications in Biology/Chemistry to their curriculum.

In 1991, the Oklahoma State Board of Regents approved the use of high school course work in Applications of Biology/Chemistry for laboratory science credit for college entrance on a temporary basis until adequate research has been completed on the merits of the class. High schools may offer Applications of Biology/Chemistry for credit if the Applications of Biology/Chemistry Curriculum written by the Center for Occupational Research and Development (CORD) is used and the teacher of the class has attended an inservice course that is approved by the State Department of Vocational and Technical Education.

As schools try to implement classes in Applications of Biology/Chemistry, they must employ a teacher that has been trained in the use of the CORD curriculum. Most teachers of traditional subjects agree with the educational value of applied academics, but the actual implementation of the curriculum can be difficult. "Teachers need to understand the curriculum so that problems can be minimized and learning activities can be used to increase understanding and retention rates of scientific concepts by the students. In order to accomplish this goal, educators must understand the different learning styles and provide experiences which fulfill the needs of the learner." (Wilson, 1994, p.4) Because of this difficulty, the type and quality of inservice training is critical and must be monitored for constancy and uniformity of objectives by the presenting instructors.

Problem

As schools try to implement classes in Applications of Biology/Chemistry, they must employ a teacher who has been trained in the use of the CORD curriculum. Most teachers of traditional subjects agree with the educational value of applied academics, but the actual implementation of the curriculum can be difficult. "Teachers need to understand the curriculum so that problems can be minimized and learning activities can be used to increase understanding and retention rates of scientific concepts by the students. In order to accomplish this goal, educators must understand the different learning styles and provide experiences which fulfill the needs of the learner." (Wilson, 1994, p.4) Because of this difficulty, the type and quality of inservice training is critical and must be monitored for constancy and uniformity of objectives by the presenting instructors.

The workshops of this study had similar instructional format and content because each of the studied workshops were presented by an instructor that either participated in or instructed at a workshop offered at Oklahoma State University. The format was designed to provide instruction on the proper teaching and utilization of the curriculum written by CORD for Applications in Applied Biology/Chemistry. All workshops were taught in a manner that allowed participants to interact with the different areas of the curriculum in a hands-on contextual approach. The time-lines of the workshops differed according to the needs of the groups.

Purpose

The purpose of this study was to determine participants' assessment of inservice training workshops for teaching the Applications in Biology/Chemistry curriculum in terms of the extent to which selected outcomes were and should have been accomplished.

Objectives

To accomplish the purpose of the study, a set of specific objectives were formulated and are listed below. The study sought to determine the extent to which participants felt the workshops did and should have accomplished the following:

1. Prepare you to teach a course in ABC for high school credit.

2. Introduce the CORD ABC materials and explain how to use them in a high school class for science credit.

3. Provide examples for time lines and structure of curriculum for a stand-alone course.

4. Explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry.

5. Explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students.

6. Provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom.

7. Define cooperative learning and give examples of ways to utilize it in the classroom.

8. Discuss the challenges of using cooperative learning groups, strategies for grouping students and the structure of cooperative learning activities.

9. Explain the use of the job profiles included in the CORD curriculum.

10. Explain the use of the student activities included in the CORD curriculum.

11. Explain the use of the Activities by Occupational Area in the CORD curriculum.

12. Explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities.

13. Provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies.

14. Explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems.

15. Explain that ABC is a contextual approach to teaching laboratory science skills.

16. Explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work.

17. Provide realistic and useful fieldtrips for any community.

18. The final objective is to develop a uniform set of guidelines for Applications in Biology/Chemistry workshops that could be used for certification by the State Department of Vocational and Technical Education.

Hypothesis

Listed below is the hypothesis which was constructed to achieve the objectives of the study:

Ho1- There is no significant difference between the expected satisfaction and the actual satisfaction of the teachers who attended the different workshops in this study.

Hypothesis Testing

A t-test analysis was used to determine whether significant differences existed between the expected outcome and the actual outcome for each of the seventeen questions asked of the respondents, and their scores were combined into four instructor groups. An alpha level of α=.05 was used to determine statistical significance. The t-test was used to determine just how great the difference between two or more means must be for it to be judged significant, that is a significant departure from differences, which might be expected from chance alone. Another way of stating the function of the t-test is to assert that through its use, we test the null hypothesis that the four groups means are not significantly different, that is, the means are so similar that the same groups can be considered to have been drawn from the same population (Popham 1973, pg.125).

Scope

The scope of the study consisted of the respondents to a survey sent to the teacher participants of 11 inservice workshops for the Applied Biology/ Chemistry curriculum developed by CORD as the main instruction material. Four different instructors held workshops in Oklahoma that were sanctioned by the State Department of Vocational Education, which certified teachers of Applied Biology/Chemistry classes for high school credit as a laboratory science requirement.

The four instructors held eleven workshops that had one hundred and sixty-one people attending. Fifty-five of the students attending the workshops said they did not intend to teach an Applied Biology/Chemistry course for high school credit. One hundred and six surveys were sent to teachers who attended the workshops. Sixty-two (58%) teachers returned the questionnaire indicating they were or had taught Applied Biology/Chemistry classes for high school credit.

The Workshops

Group 1 presented seven workshops. Each workshop was team taught and included graduate students, agriculture education teachers, and science teachers. They were ten days in duration and had an all day format including actual field trips and cooperative learning modules. Surveys were not sent to participants of this group that were identified as graduate students or agriculture education teachers. A total of seventy-three surveys were sent and thirty-nine (53%) teachers responded and one teacher returned a survey that was left blank, stating he did not wish to participate in the study.

Group 2 consisted of two workshops. The workshops were offered at a regional university for college credit. The duration of the workshops was ten consecutive days with eight hours of daily instruction. Surveys were not sent to participants of this group that were undergraduate students or those who indicated that they were not science teachers. A total of sixteen surveys were sent and 7 (44%) teachers responded.

Group 3 was part of a school-to-work consortium that paid a stipend and was held in the summer to train future applied biology/chemistry teachers for the consortium's schools. The duration of the workshops was ten consecutive days with eight hours of daily instruction. All participants were science teachers. A total of seven surveys were sent and 5 (71%) teachers responded.

Group 4 was part of a workshop presented for a school-to-work consortium. All participants were employed by the consortium and were teaching applied biology/chemistry at the time of the workshop. The workshops were held during the school year and were three two-day sessions in length. Each session was at least a month apart. A total of ten surveys were sent and 9 (90%) teachers responded and one teacher left the survey blank and indicated she did not wish to respond to the survey. The surveys were handed out at the completion of the workshop by the instructor, and participants completed the survey and returned it before being dismissed from the workshop.

Questionnaire/Measuring Instrument

A questionnaire was developed to measure the degree of satisfaction with the attended workshop as compared to the expected satisfaction of the respondents. The questionnaire was made up of seventeen questions that related to the needs of teachers of Applications of Biology/Chemistry and the proper use of the Biology/Chemistry curriculum written by the Center for Occupational Research and Development. Respondents were also asked to design an Application of Biology/Chemistry workshop that would meet the needs of the teachers and encourage attendance. This was measured by the same seventeen questions previously mentioned above and eight questions that dealt with the physical structure and timing of a workshop.

Analysis Procedure

This study compared four groups of ABC workshop participants. Each of the four groups was instructed by a different person and with a different syllabus for each workshop, but all workshops were intended to prepare teacher to instruct a class for high school credit in Applied Biology/Chemistry using the curriculum written by the Center for Occupation Research and Development. The quantitative comparison of the groups was done from their responses to the questionnaire. Since this study was made up of four groups in each situation, the t-test for paired two samples for means was used to test for significant differences between the group means. The significant level of .05 was used as the level for acceptance or rejection of each of the seventeen questions The t-test was calculated using the Microsoft Excel statistical software for microcomputers.

Discussion of the Research Findings

The purpose of this section of the chapter is to provide a summary of the findings of the study as they relate to the objectives and the hypothesis set forth at the beginning.

Hypothesis 1-There is no significant difference between the expected satisfaction and the actual satisfaction of the teachers who attended the different workshops in this study.

After all the data was compiled on all seventeen questions from all the responding groups, a t-test was used on each of the questions to determine just how great the difference between two means must be for it to be judged significant. Eleven (11) of the seventeen (17) questions were found to have a significant difference of at least .05 level or greater, therefore Hypothesis 1 was rejected.

Each of the questions was related to one of the objectives of this study and will be addressed individually. Because of the difference in the size of the groups, the t-test of means did not always truly reflect the difference in mean scores.

Objective 1: Prepare you to teach a course in ABC for high school credit. The t-test revealed that the only group where the difference was significant was Group 1 (α=.001) and the Total of all respondents (α=.000007), but all groups showed noticeable difference in the mean scores. Group 3 had the largest difference in the mean scores but did not show significant because of the small number of group members. The workshops expectation was high and satisfaction of the respondents was somewhat lower. All groups felt that the workshop they attended did not fully meet their expectation of the training that they would receive. This difference would appear to indicate that all of the studied workshops needed to improve the instruction somewhat.

TABLE XVIII

PREPARE YOU TO TEACH A COURSE IN ABC FOR HIGH SCHOOL CREDIT

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.86	6.46	.60	(.001) **
Group 2	7	5.71	6.14	.43	(.481)
Group 3	5	5.00	5.80	.80	(.099)
Group 4	9	6.00	6.66	.66	(.080)
TOTAL	60	5.78	6.40	.62	(.000007) **

* Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 2: Introduce the CORD ABC material and explain how to use them in a high school class for science credit. The t-test revealed that the only group where the difference was significant was Group 1 (α=.01) and the Total (α=.002)), but all groups showed a noticeable difference in the mean scores. Group 3 had the largest difference in the mean scores but did not show significant because of the small number of group members. Group 4 had the lowest difference in mean scores, or was the group that was the most satisfied. The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XIX

INTRODUCE THE CORD ABC MATERIALS AND EXPLAIN HOW TO USE THEM IN A HIGH SCHOOL CLASS FOR SCIENCE CREDIT

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	6.15	6.61	.46	(.01) **
Group 2	7	5.71	6.00	.29	(.17)
Group 3	5	5.00	5.60	.60	(.20)
Group 4	9	6.55	6.66	.11	(.34)
TOTAL	60	6.06	6.46	.40	(.0002) **

*Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 3: Provide examples for time lines and structure of the curriculum for a stand-alone course. The t-test revealed that three of the groups had scores in which the differences were significant--Group 1 (α=.006) and Group 2 (α=.047 Total (.0005). The mean scores for both expected and actual satisfaction were low, and the difference in mean scores was high. The high difference in the mean scores indicated that more instruction was needed on how to structure the curriculum for a stand-alone course, and what time lines to use with the curriculum. All workshops reported a large difference in mean scores except Group 3, which had the lowest difference (.20). The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XX

PROVIDE EXAMPLES FOR TIME LINES AND STRUCTURE OF CURRICULUM FOR A STAND-ALONE COURSE

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.02	6.02	1.00	(.006)**
Group 2	7	4.71	5.85	1.14	(.047)*
Group 3	5	5.20	5.40	.20	(.37)
Group 4	9	5.55	6.00	.45	(.10)
TOTAL	60	5.08	5.95	.87	(.0005)**

*Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 4: Explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry. The t-test revealed that three of the groups had scores in which the differences were significant--Group 1(α=.001) Group 4 (α=.04) Total (α= .0000039). The mean scores for both expected and actual satisfaction were low, and the difference in mean scores was high. The high difference in the mean scores indicated that more instruction was needed on the how the CORD curriculum would meet the State P.A.S.S. objectives and the State Learner Outcomes for College entry, by all of the studied workshop instructors.

TABLE XXI

EXPLAIN HOW THE CORD CURRICULUM WOULD MEET THE P.A.S.S. OBJECTIVES AND THE LEARNER OUTCOMES FOR COLLEGE ENTRY

	N=	***EXTENT ACCOMPLISHED MEAN***	***EXTENT SHOULD HAVE ACCOMPLISHED MEAN***	***MEAN DIFFERENCE / (T<=t)***	
Group 1	39	5.10	6.25	1.15	(.001)**
Group 2	7	4.71	5.71	1.00	(.13)
Group 3	5	4.00	4.60	.6	(.07)
Group 4	9	6.22	6.22	1.11	(.04)*
TOTAL	60	5.00	6.05	1.05	(.0000039)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 5: Explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students. No group had a mean score high enough to call significant. Group 3 had the lowest satisfaction (4.40) and the lowest expectation(4.00). This low rating would imply that the respondents and the instructors of group 3 may not have considered this objective important to the needs of teachers of Applied science. Group 4 satisfaction and expectation were the same(6.22) and this score was the highest rating.

TABLE XXII

EXPLAIN THE DIFFERENT TYPES OF LEARNING STYLES AND HOW TO USE DIFFERENT TYPES OF TEACHING STYLES TO MAKE THE CURRICULUM MORE INCLUSIVE FOR ALL STUDENTS

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.35	5.76	.41	(.021)
Group 2	7	4.42	5.28	.86	(.17)
Group 3	5	4.00	4.40	.40	(.17)
Group 4	9	6.22	6.22	.00	(1.00)
TOTAL	60	5.26	5.66	.40	(.07)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (low1 to High 7)

Objective 6: Provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom. The t-test revealed that Group 1 (α=.006) and the Total (α=.001) had mean scores that were significant. Group 3 had the lowest expectation (4.60) and the lowest satisfaction (4.40) and thus the low score could imply that the respondents and the instructors did not think that teacher modeling was important to the teaching of Applied Science. The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XXIII

PROVIDE EXAMPLES OF DIFFERENT WAYS FOR TEACHERS TO MODEL IMPORTANT SCIENCE SKILLS AND EMPHASIZE THE IMPORTANCE OF MODELING SKILLS IN THE CLASSROOM

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.25	6.05	.80	(.006)**
Group 2	7	5.57	6.42	.85	(0.22)
Group 3	5	4.40	4.60	.20	(0.37)
Group 4	9	6.44	6.55	.11	(0.68)
TOTAL	60	5.40	6.05	.65	(.001)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 7: Define cooperative learning and give examples of ways to utilize it in the classroom. The t-test revealed that there was no significant difference in the groups or the total means scores. Some of the groups did feel that instruction exceeded expectation--Group 2 , Group3 and the Total score. All groups felt that instruction in this area was high.

TABLE XXIV

DEFINE COOPERATIVE LEARNING AND GIVE EXAMPLES OF WAYS TO UTILIZE IT IN THE CLASSROOM

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	6.15	6.25	.10	(0.86)
Group 2	7	5.71	5.57	-.14	(0.82)
Group 3	5	5.40	4.60	-.80	(0.09)
Group 4	9	6.11	6.33	.22	(0.51)
TOTAL	60	6.03	6.01	-.02	(0.94)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 8: Discuss the challenges of using cooperative learning groups, strategies for grouping students and the structure of cooperative learning activities. The t-test revealed that there was no significant difference reported, but showed that Group 3 satisfaction exceeded expectation and all groups had high levels of satisfaction.

TABLE XXV

DISCUSS THE CHALLENGES OF USING COOPERATIVE LEARNING GROUPS, STRATEGIES FOR GROUPING STUDENTS AND THE STRUCTURE OF COOPERATIVE LEARNING ACTIVITIES

	N=	***EXTENT ACCOMPLISHED MEAN***	***EXTENT SHOULD HAVE ACCOMPLISHED MEAN***	***MEAN DIFFERENCE / (T<=t)***	
Group 1	39	5.64	6.10	.46	(0.14)
Group 2	7	5.14	5.57	.43	(0.50)
Group 3	5	5.60	4.60	1.00	(0.08)
Group 4	9	5.88	6.00	.12	(0.34)
TOTAL	60	5.58	5.86	.28	(0.22)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 9: Explain the use of the job profiles included in the CORD curriculum. The t-test revealed that the only group where the difference was significant was Group 1 (α=.0003) and the Total (α=.0003). Group 4 did feel that the workshop exceeded their expectations, but as a total, the respondents felt that instruction in this area needed significant improvement, indicated by the large difference in mean scores.

TABLE XXVI

EXPLAIN THE USE OF THE JOB PROFILES INCLUDED IN THE CORD CURRICULUM

	N=	***EXTENT ACCOMPLISHED MEAN***	***EXTENT SHOULD HAVE ACCOMPLISHED MEAN***	***MEAN DIFFERENCE / (T<=t)***	
Group 1	39	4.89	6.10	1.21	(.0003)**
Group 2	7	5.57	6.00	.43	(0.35)
Group 3	5	4.60	5.00	.40	(0.47)
Group 4	9	6.11	6.00	-.11	(0.72)
TOTAL	60	5.13	5.98	.85	(.0003)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 10: Explain the use of the student activities included in the CORD curriculum. The t-test revealed that the only group where the difference was significant was Group 1 (α=.03) and the Total (α=.01). Group 4 did feel that the workshop training and their expectations were equal. The satisfaction varied between groups significantly but the total indicated more instruction needed.

TABLE XXVII

EXPLAIN THE USE OF THE STUDENT ACTIVITIES INCLUDED IN THE CORD CURRICULUM

	N=	***EXTENT ACCOMPLISHED MEAN***	***EXTENT SHOULD HAVE ACCOMPLISHED MEAN***	***MEAN DIFFERENCE / (T<=t)***	
Group 1	39	5.71	6.30	.59	(.03)*
Group 2	7	6.14	6.28	.14	(0.73)
Group 3	5	4.80	5.80	1.00	(0.14)
Group 4	9	6.55	6.55	0	(1.00)
TOTAL	60	5.81	6.30	.49	(.01)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 11: Explain the use of the Activities by Occupational Area in the CORD curriculum. The t-test revealed that the only group where the difference was significant was Group 1 (α=.0006) and the Total (α=.0006). Group 4 did feel that the workshop training and their expectations were equal. An analysis of the mean scores revealed wide variance between the groups from zero in Group 4 to 1.43 in Group 2. Mean variance was high in all groups except Group 4 with the Total variance of .82, indicating a lack of satisfaction with more instruction needed.

TABLE XXVIII

EXPLAIN THE USE OF THE ACTIVITIES BY OCCUPATIONAL AREA IN THE CORD CURRICULUM

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.12	6.05	.93	(.006)**
Group 2	7	3.85	5.28	1.43	(0.07)
Group 3	5	4.60	5.20	.60	(0.20)
Group 4	9	6.44	6.44	0	(1.00)
TOTAL	60	5.13	5.95	.82	(.0006)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 12: Explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities. The t-test revealed that the only group where the difference was significant was Group 1 (α=.0004) and the Total (α=.0001). Group 2 was the only group where the workshop exceeded the respondents' expectations of instruction. Because of the small number of respondents in Groups 2, 3 and 4, their mean score satisfaction was significantly less than the total. Group 1's large number of respondents and its mean score difference in expectation and satisfaction caused the total mean difference to be high. The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XXIX

EXPLAIN THE USE OF THE LABORATORY ACTIVITIES AND INCLUDED EQUIPMENT AND MATERIALS, LAB PREPARATION GUIDE, SAMPLE DATA AND SOLUTIONS TO QUESTIONS, AND OPTIONAL EXTENSIONS OF THE LAB ACTIVITIES

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.48	6.58	1.10	(.0004)**
Group 2	7	6.42	6.00	-.42	(0.40)
Group 3	5	5.60	6.00	.40	(0.47)
Group 4	9	6.88	7.00	.12	(0.34)
TOTAL	60	5.81	6.53	.72	(.001)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 13: Provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies. The t-test revealed that there was no significant difference in the groups and total mean scores. Group 2 did feel that the workshop exceeded their expectations and Group 4 felt the workshop met their expectations.

TABLE XXX

PROVIDE INFORMATION ON THE EQUIPMENT AND MATERIALS NEEDED FOR THE CURRICULUM AND POSSIBLE VENDORS OF EQUIPMENT AND SUPPLIES

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.94	6.46	.52	(0.06)
Group 2	7	6.28	5.85	-.43	(0.53)
Group 3	5	5.40	6.40	1.00	(0.08)
Group 4	9	6.88	6.88	0	(0.00)
TOTAL	60	6.08	6.45	.37	(0.06)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 14: Explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems. The t-test revealed that only two groups showed significant differences, Group 1 (α=.05) and the Total (α=.003). The smallness of Groups 2, 3 and 4 affected their mean difference totals. Group 2 had the greatest lack of satisfaction, (.86);Group 3 the smallest, (.20). Even though the t-test showed significance in the Total group, mean difference was considered low. The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XXXI

EXPLAIN THE USE OF THE CORD VIDEOS AND GIVE SUGGESTED QUESTIONS FOR DISCUSSION AND OUTLINE POSSIBLE SOLUTIONS TO PROBLEMS

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.82	6.20	.38	(0.05)*
Group 2	7	4.42	5.28	.86	(0.11)
Group 3	5	5.40	5.60	.20	(0.70)
Group 4	9	5.22	5.88	.66	(0.80)
TOTAL	60	5.51	6.01	.50	(.003)**

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 15: Explain that ABC is a contextual approach to teaching laboratory science skills. The t-test revealed that there was no significant difference in the groups and total mean scores. Groups 2 and 4 did feel that the workshop training exceeded their expectations.

TABLE XXXII

EXPLAIN THAT ABC IS A CONTEXTUAL APPROACH TO TEACHING LABORATORY SCIENCE SKILLS

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*	
Group 1	39	5.89	6.20	.31	(0.23)
Group 2	7	6.57	5.71	-.86	(0.30)
Group 3	5	5.00	5.60	.60	(0.20)
Group 4	9	6.66	6.55	-.11	(0.34)
TOTAL	60	6.01	6.15	.14	(0.49)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 16: Explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work. The t-test revealed that the only group where the difference was significant was Group 1 (α=.03). The mean score difference revealed that Group 2, (-.43), and Group 4, (-.22), felt that the workshop training exceeded their expectations. The level of significance and the difference in mean scores indicates that all studied workshops needed to improve instruction in this area somewhat.

TABLE XXXIII

EXPLAIN THAT SCIENCE CONCEPTS PRESENTED IN ABC SHOULD BE TAUGHT RELATIVE TO LIFE, HOME, SOCIETY, AND THE WORLD OF WORK

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*
Group 1	39	6.05	6.56	.51 (0.03)*
Group 2	7	6.71	6.28	-.43 (0.35)
Group 3	5	5.00	5.80	.80 (0.09)
Group 4	9	6.88	6.66	-.22 (0.16)
TOTAL	60	6.16	6.48	.32 (0.07)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 17: Provide realistic and useful fieldtrips for any community. The t-test revealed that there was no significant difference in the groups and total mean scores. Group 2 did feel that the workshop training exceeded their expectations. Total mean scores revealed that expectation and satisfaction were low on this objective.

TABLE XXXIV

PROVIDE REALISTIC AND USEFUL FIELDTRIPS FOR ANY COMMUNITY

	N=	*EXTENT ACCOMPLISHED MEAN*	*EXTENT SHOULD HAVE ACCOMPLISHED MEAN*	*MEAN DIFFERENCE / (T<=t)*
Group 1	39	6.02	6.20	.18 (0.59)
Group 2	7	5.71	5.42	-.29 (0.60)
Group 3	5	4.60	5.20	.60 (0.07)
Group 4	9	5.33	5.66	.35 (0.34)
TOTAL	60	5.76	5.95	.19 (0.42)

Significant beyond .05 level ** Significant beyond .01 level
Questionnaire Scale Values (Low 1 to High 7)

Objective 18: The final objective was to develop a uniform set of guidelines for Applications in Biology/Chemistry workshops that could be used for certification by the State Department of Vocational and Technical Education.

Objective 18 was answered by the analysis of the previous seventeen objectives as related to the first seventeen questions on the questionnaire in conjunction with questions 18-25. Analysis of the first seventeen questions revealed that the respondents' satisfaction with their attended workshops was above the response scale average of 4. Thus, the seventeen objectives were met and should continue to be objectives of future workshops. Questions 18-25 dealt with the physical make-up of the workshops and were intended to give respondents the opportunity to help design a workshop for inservice training for future teachers of Applications of Biology/Chemistry that will better meet the needs of educators that will be using the CORD curriculum. The first seventeen objectives dealt with meeting the needs of future teachers of Applications of Biology/Chemistry for high school credit using the CORD curriculum. The last eight questions from the survey dealt with the design of the workshop to encourage attendance of future teachers of applied science courses.

Therefore, if the purpose of inservice training is to prepare teachers of science to implement the Applied Biology/Chemistry (ABC) curriculum and course materials in the high school, the guidelines submitted by the respondents to the questionnaire, for Applications in Biology/Chemistry workshops, could be used for certification by the State Department of Vocational and Technical Education. They are as follows:

1. The inservice training workshop should prepare teachers to teach a course in ABC for high school credit.

2. The inservice training workshop should introduce the CORD ABC materials and explain how to use them in a high school class for science credit.

3. The inservice training workshop should provide examples for time lines and structure of curriculum for a stand-alone course.

4. The inservice training workshop should explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for college entry.

5. The inservice training workshop should explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students.

6. The inservice training workshop should provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom.

7. The inservice training workshop should define cooperative learning and give examples of ways to utilize it in the classroom.

8. The inservice training workshop should discuss the challenges of using cooperative learning groups, strategies for grouping students and the structure of cooperative learning activities.

9. The inservice training workshop should explain the use of the job profiles included in the CORD curriculum.

10. The inservice training workshop should explain the use of the student activities included in the CORD curriculum.

11. The inservice training workshop should explain the use of the Activities by Occupational Area in the CORD curriculum.

12. The inservice training workshop should explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities.

13. The inservice training workshop should provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies.

14. The inservice training workshop should explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems.

15. The inservice training workshop should explain that ABC is a contextual approach to teaching laboratory science skills.

16. The inservice training workshop should explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work.

17. The inservice training workshop should provide realistic and useful fieldtrips for any community.

18. The inservice training workshop should be at least ten days in length.

19. The inservice training workshop should utilize consecutive days, although two-day sessions are acceptable to facilitate attendance during the school year.

20. The inservice training workshop should be six to eight hours of daily instruction.

21. The inservice training workshop should meet for a complete week, Monday thru Friday, except those sessions offered during the school year.

22. The inservice training workshop should be offered in the summer whenever possible.

23. The inservice training workshop should offer and require follow-up sessions at least yearly.

24. The inservice training workshop should offer college credit to encourage attendance.

25. The inservice training workshop should provide a stipend for attendees (could be provided by the local school or State Vo-Tech Dept.).

Conclusions

The following section identifies the conclusion of the study as related to the objectives.

All instructors of the four studied workshops either attended or participated in a workshop provided by Oklahoma State University on Applied Biology/Chemistry with the use of the CORD curriculum for Applied Biology/Chemistry as the subject and with Professors Ted Mills and James Key as participating instructors.

Therefore it was concluded from the research that the workshops all followed the same instructional format, but some of them used different time lines.

The first seventeen questions revealed that the respondents' satisfaction was above average on the workshops they attended, thereby meeting the first seventeen objectives. *Therefore, it was concluded that the first seventeen objectives of this study should be the mainstay of any workshop used to train future teachers of Applications of Biology/Chemistry for high school credit.*

Eleven of the first seventeen objectives were found to be statistically significant. *Therefore, it was concluded that an increased emphasis on instruction in the guideline (objectives) areas that were statistically significant be provided.* Those eleven guidelines are as follows:

1. The inservice training should prepare you to teach a course in ABC for high school credit.

2. The inservice training should introduce the CORD ABC materials and explain how to use them in a high school class for science credit.

3. The inservice training should provide examples for time lines and structure of curriculum for a stand-alone course.

4. The inservice training should explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry.

6. The inservice training should explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive to all students.

9. The inservice training should explain the use of the job profiles included in the CORD curriculum.

10. The inservice training should explain the use of the student activities included in the CORD curriculum.

11. The inservice training should explain the use of the Activities by Occupational Area in the CORD curriculum.

12. The inservice training should explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities.

13. The inservice training should explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems.

14. The inservice training should explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work.

Survey questions 18-25 provided insight on time line configuration and structure of the workshops. *Therefore, it was concluded that workshops should be ten days in length, 6-8 hours a day, with follow-up sessions offered, college credit given and a* *stipend offered. The days, months and structure of meetings should be arranged to facilitate attendance by participants.*

Recommendations

The following list of recommendations is provided in relation to the outcomes of the study:

1. The State Department of Vocational Education, in conjunction with the Center for Occupational Research and Development, should establish workshop guidelines and teacher certification requirements for teaching Applied Academic courses for high school credit.

2. Workshops should include instructors that have taught Applied Biology/Chemistry classes for high school using the CORD ABC curriculum.

3. The State Department of Vocational Education should provide follow-up sessions for all instructors of Applied courses for high school credit that allows for participant input at Vo-Tech summer conference.

4. Physical structure and time line of workshops should be designed in a manner that facilitates participation.

5. The State Department of Vocational Education should work in conjunction with state colleges and universities to provide workshops that offer college credit acceptable for degree programs and certification for the participants.

Recommendations for Further Research

1. Research should be done comparing the course syllabi of workshops presented by CORD instructors versus workshops used by the State Department of Vocational Education for certification of instructors of Applied Biology/Chemistry in Oklahoma.

2. Research should be done comparing the course content of Applied Biology/Chemistry classes within the state of Oklahoma used for high school credit as a laboratory science.

3. Research should be done concerning school administrators' perceptions of Applied Biology/Chemistry courses taught for high school credit.

4. Research should be done concerning the inservice training of Applied Academic instructors in other states than Oklahoma.

Concluding Comments

If Applied Academics courses are to be a part of the national school reform movement and instruction improved to make the curriculum more inclusive for all students, then training and support for instructors of these applied courses is essential. The review of literature provides us with a glimpse of the need for change within the educational system. The present system was designed for the industrial age, when people had predictable jobs, at predictable times, requiring predictable skills, since they were going to be employed in predictable places. We now know that the high point of this industrial society was the mid-fifties. For the past 40 years our economy has been changing into something else—but our educational system has not.

As the problems in education become more alarming, the reaction is very much the same as in business. The tougher things get, the more people play it safe and rely on the old tried and true. The result is an educational system that is literally bound and gagged by tradition. If the future instructors of applied academics courses are not given sufficient training and support, then they will most certainly return to the historical teaching methods of the past--of chapter and verse, and rote memorization.

SELECTED BIBLIOGRAPHY

Baker, C., Wilmoth, H. and Lewis, A. (1990). Factors affecting student achievement in a high school principle of technology course: a state case study. Auburn, AL: Center for Vocational and Adult Education; Auburn University—College of Education.

Beadles, A.R. (1992). An assessment of a pilot program of the applied biology/chemistry curriculum. Unpublished doctoral dissertation at Oklahoma State University; Stillwater, Oklahoma.

Beaumont, R. (1995). Tech Prep and School To Work; Working Together to Foster Educational Reform. Yavapai Tech Prep Consortium; Yavapai College.

Bonstingl, J.J. (March 1992). "The Total Quality Classroom." Educational Leadership 49, 6:67.

Christian, A. (1993). The course, "Principles of Agricultural Technology", physics or farce? Unpublished masters thesis at Oklahoma State University; Stillwater.

CORD. (1991). Applied Biology curriculum guide. Center for Occupational Research and Development. Waco, Texas.

Congressional record, 101st Congress 2nd Session (1990, September 25) The Carl D. Perkins Vocational and Applied Technology Act Amendments of 1990.

Dugger, J. and Johnson, D. (1989). A comparison of principles of technology and high school physics student achievement using a principles of technology achievement test. Journal of Technology Education. 4(1), pp. 19-26.

Elsbree, W.S. (1939). The American Teacher. American Book Co.: New York.

Ferguson, M. (1980). The Aquarian Conspiracy. Los Angeles, CA.: Tarcher.

Hamby, J.L. (1995). An assessment of the applied biology/chemistry curriculum in selected Oklahoma schools. Unpublished doctoral dissertation at Oklahoma State University; Stillwater, Oklahoma.

Hermanowicz, H.J. (1966). "The pluralistic world of beginning teachers". The Real World of the Beginning Teacher, pp. 15-25. Report of the nineteenth national TEPS conference. National Educational Association: Washington, D.C.

Hoerner, J.L. (1991). Tech Prep and Educational Reform. Berkeley, CA: NCRVE

Houdis, P. (1994). Applications of biology/chemistry: evaluation of an applied science curriculum. Consultant staff study by MPR Associates Incorporated; Berkley, California.

Juran, J.M. (1988). Juran on Planning for Quality. New York: The Free Press.

Key, J. and Lee-Cooper, K. (1994). A comparison between applied biology/chemistry and traditional biology/chemistry. Department paper by the Department of Agricultural Education, Communications and 4-H Youth Development at Oklahoma State University; Stillwater, Oklahoma.

Lackard, B.E. (1995). "Scans and the New Vocationalism". EDO-CE-95-165.

Lortie, D.C. (1969). "The balance of control and autonomy in elementary school teaching". The Semi-Professions and their Organization, pp. 1-53. Free Press: New York.

Lynch, R.F. (April 1991). "Shedding the Shackles of George Patton, Henry Ford, and First-Grade Teachers." Quality Progress, p. 64.

Mason, W.S. (1961). "The Beginning Teacher". U.S. Department of Health, Education, and Welfare, Office of Education, circular no. 644: Washington, D.C.

Miles-Wilson, K. (1994). A comparison of the applied biology/chemistry curriculum to the traditional biology curriculum. (Unpublished doctoral dissertation at Oklahoma State University; Stillwater, Oklahoma.

National Secondary Vocational Education Commission. (1984). The unfinished agenda: The role of vocational education in the high school. Ohio State University: Columbus, Ohio.

Pepple, J., and O'Connor, F. (1992). An evaluation of the applied mathematics and applied communication demonstration sites in Indiana. Unpublished manuscript, University of Illinois, Department of Curriculum and Instruction, Illinois.

Popham, W.J. (1973). Educational Statistics: Use and Interpretation. New York: Harper and Row.

School of Education. (1995). Applied Academics Trainer's Guide. Colorado State University: Ft. Collins.

Taylor, L. (1968). Occupational Sociology. Oxford University Press: New York.

Tyack, D.B. (1967). Turning Points in American Educational History. Blaisdell: Waltham, Massachusetts.

Von Oech, R. (1983). A Whack on the Side of the Head. New York: Warner.

Wilson, K.K.M. (1994). An assessment of applied biology/chemistry curriculum as compared to traditional biology curriculum. Unpublished doctoral dissertation at Oklahoma State University; Stillwater, Oklahoma.

APPENDIXES

APPENDIX A

OKLAHOMA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

HUMAN SUBJECTS REVIEW

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 01-02-96 **IRB#:** AG-96-009

Proposal Title: AN ASSESSMENT OF THE INSERVICE TRAINING PROVIDED FOR FUTURE TEACHERS OF APPLICATIONS IN BIOLOGY/CHEMISTRY FOR HIGH SCHOOL CREDIT USING THE CURRICULUM WRITTEN BY THE CENTER FOR OCCUPATIONAL RESEARCH AND DEVELOPMENT

Principal Investigator(s): James P. Key, Robert D. Jobe

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: John H. Wyckoff

Chair of Institutional Review Board

Date: January 4, 1996

APPENDIX B

Questionnaire Survey

Dear ABC Workshop Participant:

Thank you for taking the time to read and help with this research project. My name is Robert Jobe and I am working on my Doctoral Degree in Agricultural Education under Dr. Key. He and I would like to find out your opinion of the Applications of Biology/Chemistry Curriculum (ABC) workshop that you attended, now that you have had a chance to use the curriculum in your school.

This study will deal with the ABC curriculum, as written by the Center for Occupational Research and Development (CORD), and an evaluation of the implementation training received by those teachers who attended an ABC workshop approved by the Oklahoma State Department of Vocational and Technical Education. Your response is extremely valuable because you are one of the select few who know the truth about teaching with the ABC curriculum. On the questionnaire, please answer the questions about the ABC curriculum and the training you received, to best of your ability. Your perceptions are crucial to our understanding whether this curriculum and your training will improve science education for your students. You are the professional that fights the daily battles of the classroom to try to educate our young people in science.

Thank you very much for your help. This information will help improve curriculum for our students and the training of future teachers of Applications of Biology/Chemistry. The information that you provide for this study will be confidential and will only be reported as combined data. Your responses will not be associated with your name at all.

Robert D. Jobe James P. Key Ted R. Mills Alvin R. Beadles

On the following questions, please rate the workshop that you attended on the left hand side, by circling the most appropriate number. On the right hand side, rate the question according to the level of importance you feel it has to the needs of teachers of Applications of Biology/Chemistry:

To what degree of satisfaction **did** the workshop:		To what degree of satisfaction **should** the workshop:
LOW 1 2 3 4 5 6 7 HIGH	1. prepare you to teach a course in ABC for high school credit	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	2. introduce the CORD ABC materials and explain how to use them in a high school class for science credit	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	3. provide examples for time lines and structure of curriculum for a stand-alone course	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	4. explain how the CORD curriculum would meet the P.A.S.S. objectives and the Learner Outcomes for College entry	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	5. explain the different types of learning styles and how to use different types of teaching styles to make the curriculum more inclusive for all students	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	6. provide examples of different ways for teachers to model important science skills and emphasize the importance of modeling skills in the classroom	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	7. define cooperative learning and give examples of ways to utilize it in the classroom	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	8. discuss the challenges of using cooperative learning groups, strategies for grouping students and structure of cooperative learning activities	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	9. explain the use of job profiles included in the CORD curriculum	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	10. explain the use of the student activities included in the CORD curriculum	LOW 1 2 3 4 5 6 7 HIGH

LOW 1 2 3 4 5 6 7 HIGH	11. explain the use of the Activities by Occupational Area in the CORD curriculum	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	12. explain the use of the laboratory activities and included equipment and materials, lab preparation guide, sample data and solutions to questions, and optional extensions of the lab activities	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	13. provide information on the equipment and materials needed for the curriculum and possible vendors of equipment and supplies	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	14. explain the use of the CORD videos and give suggested questions for discussion and outline possible solutions to problems	LOW 1 2 3 4 5 6 7HIGH
LOW 1 2 3 4 5 6 7 HIGH	15. explain that ABC is a contextual approach to teaching laboratory science skills	LOW 1 2 3 4 5 6 7HIGH
LOW 1 2 3 4 5 6 7 HIGH	16. explain that science concepts presented in ABC should be taught relative to life, home, society, and the world of work	LOW 1 2 3 4 5 6 7 HIGH
LOW 1 2 3 4 5 6 7 HIGH	17. provide realistic and useful field-trips for any community	LOW 1 2 3 4 5 6 7 HIGH

On this part of the questionnaire you have the opportunity to help design a workshop for inservice training for future teachers of Applications of Biology/Chemistry that will better meet the needs of educators that will be using the CORD curriculum. The workshop must meet the needs of the teacher, plus be designed to encourage attendance. Please feel free to write in any comments that you feel are important to the training of future teachers of ABC courses for high school credit.

18. How long should the inservice training be? Number of days______________
19. How should the days be scheduled? (e.g. all in a row, three two-day sessions)
    ____
20. Number of hours per day of instruction ______________________________
21. What are the best days of the week? ______________________________
22. What months of the year are the best times? __________________________
23. Should a follow-up session be offered one year after the workshop to help with any difficulties that teachers may have? Yes/No
24. Should college credit be offered? Yes/No
25. Should a stipend be paid for attendance? Yes/No

Please answer the following:

Age _______________
Gender Male ( ) Female ( )
Marital Status Single ( ) Married ( )
How long have you been teaching? ________years
When did you attend an ABC workshop? _______month ________year
Please list instructor(s) of workshop ____
Are you teaching an applied science class at present? Yes/No
Number of years teaching applied science class ________years
How long have you taught science classes? ________years
Which of the ABC curriculum units written by CORD do you use with each class? Place the corresponding number in the blank--1. Biology I 2. Biology II 3. Chemistry I 4. Chemistry II

1. Natural Resources ___ 2. Water ___ 3. Air and Other Gases ___
4. Disease and Wellness ___ 5. Continuity of Life ___ 6. Nutrition ___
7. Micro-Organisms ___ 8. Plant Growth & Reproduction ___
9. Animal Life Processes ___ 10. Synthetic Material ___

Do you use any other textbook with the Applied Science class? Yes/No
If yes, list ____
What percent of the time do you use the Cooperative Learning method with each unit that you teach from the CORD curriculum? ___________%
How long was the workshop that you attended? ________days
If college credit was offered, how many hours? ________hours
Through what institution? ______________
Was there any inservice fee other than tuition? _____________
Was there any type of stipend paid to you? Yes/No Who provided it? ________________

Thank you for your input!!

Please add any additional information that you feel is important to the development of the ideal inservice workshop for Applications of Biology/Chemistry.

2

VITA

Robert Dale Jobe

Candidate for the Degree of

Doctor of Education

Thesis: AN ASSESSMENT OF INSERVICE TRAINING ON THE APPLICATIONS IN BIOLOGY/CHEMISTRY CURRICULUM FROM THE CENTER OF OCCUPATIONAL RESEARCH AND DEVELOPMENT

Major Field: Agricultural Education

Biographical:

Personal Data: Born in Tulsa, Oklahoma, on February 9, 1951, the son of Preston and Mary Jobe.

Education: Graduated from Sperry High School, Sperry, Oklahoma in May 1970; received Bachelor of Science degree in Agriculture Education from Oklahoma State University, Stillwater, Oklahoma in 1978; received Master of Science degree in Agriculture Education from Oklahoma State University, Stillwater, Oklahoma in 1987; completed the requirements for the Doctor of Education degree in Agriculture Education at Oklahoma State University in July 1997.

Professional Experience: Agriculture Education Instructor, Moore Public Schools, July 1980 to July 1984; Agriculture Education Instructor, Oklahoma Union Public Schools, July 1984 to July 1991; High School Principal, Nowata Public Schools, July 1991 to July 1993; Superintendent, Osage Public School, July 1994 to present.