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ABSTRACT

A statewide sustained effort to improve student learning in Missouri by adopting and adapting promising research-based educational practices is described. The concept of an Instructional Management System (IMS) with desired learner outcomes determining both instruction and testing was suggested to local school districts beginning in 1980. In 1985, legislation provided both funds and authority to engage large groups of teachers to create criterion-referenced tests in reading/language arts, mathematics, science, and social studies/civics for various age groups. The refinement process that resulted in the Missouri Mastery and Achievement Test batteries is described. The achievement gains of large populations of students as measured during the first 2 years for which comparative data were available are also reported. The process of periodic review and revision is also briefly described. Four tables and one figure provide achievement data. (Author/SLD)

Implementing and Assessing a Large Scale School Improvement Project

ABSTRACT

This paper describes a statewide sustained effort to improve student learning by adopting and adapting promising research-based educational practices. The concept of an Instructional Management System (IMS) with desired learner outcomes determining both instruction and testing was suggested to local school districts beginning in 1980. In 1985, legislation provided both funds and authority to engage large groups of teachers to create criterion-referenced tests in reading/language arts, mathematics, science and social studies/civics for various age groups. The refinement process which resulted in the Missouri Mastery and Achievement Test batteries is described. The achievement gains of large populations of students as measured during the first two years for which comparative data were available are also reported. The process of periodic review and revision is also briefly described.

This paper prepared for presentation at the 3rd International Congress for School Effectiveness, Jerusalem, Israel, 1990.

Implementing and Assessing a Large Scale School Improvement Project

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The school improvement project I shall describe for you today is occurring in Missouri. Missouri is a state in the center of the United States. The population of Missouri is 5,103,000. The kindergarten through grade 12 public school enrollment in Missouri is about 890,000 students.

Missouri has two urban centers, St. Louis and Kansas City. There are several middle-sized cities and many small villages. The culture of the people ranges from the Ozarks "hillbilly" to the high tech corporate executive. There are 545 local school districts and about 3000 school buildings where about 50,000 teachers work.

In the late 1970's it became embarrassingly evident that our schools were not meeting the needs of our society. This was true throughout the United States. American schools were structured and taught so that the students were classified into levels of learning early in their school careers. Through this selection process, a few students received excellent educations and others demonstrated only moderate to poor learning. Until the mid-twentieth century this type of educational structure served the economic needs of our society quite well. We needed 15 to 20 percent of our people well educated to serve as leaders in all aspects of our society. We needed many to do menial and physically demanding work which required much less high level skill or knowledge.

After World War II, it became increasingly apparent that a much higher percent of our population needed more and better

knowledge and competence to function productively in the more technically demanding society. Also, the advances in travel and communication--the shrinking world--introduced social problems that required more intercultural understandings and social skills. This background information is not new to those of the western world; we have all experienced it to some degree.

The Missouri Department of Elementary and Secondary Education (DESE) has decided over the last ten years to attempt to reverse the existing sad state of affairs. In an effort to select a long term education improvement effort, the Department studied the available research to determine what interventions or practices contribute most to increasing the "effect size" of achievement gains. Drawing on the research data pertaining to curriculum alignment, instructional alignment (Cohen, 1987, 1988), mastery learning (Guskey, 1985; Block, 1988), and cooperative learning (Johnson and Johnson, 1985, 1987) we have formulated a research-based, outcome- based educational system which we call Instructional Management System (IMS). (Mo. DESE, 1986)

The IMS concept is based on a large body of educational research, which can be summarized in the following two premises:

1. All students can learn what we teach to a satisfactory level--if teachers believe they can and if the school is organized to provide adequate time for each student to learn. (Carroll, 1963; Bloom, 1968)
2. For students to be self-motivated to continue learning throughout their school careers and throughout life, they must spend more than half their time working on tasks at which they experience high degrees of success. This implies that each student should encounter learning tasks at a rate no faster than he/she can master. Learning deficits should not be allowed to accumulate. (Ames & Ames, 1984; Guskey, 1985)

In June, 1981, the Missouri State Board of Education adopted as a top priority the implementation of an IMS in every district of the state. The remarkable feature of this action was that it made IMS a primary Board priority for the "decade of the 80's."

Seldom do policymaking boards understand the time required to bring about substantial change--especially when the constituency is large and the change is not mandatory. (Mo. DESE, 1986)

During the summer of 1981, Department staff conducted six day-long conferences on IMS in Jefferson City, the state capitol. A total of about 800 school personnel, mostly administrators, attended these meetings. They were introduced to the IMS concept and informed of the renewed state commitment to outcome-based schooling. Their response ranged from enthusiasm to skepticism, both toward the idea of IMS and toward the long-term state commitment to significant change. One superintendent, who was asked by a colleague how he planned to respond to the call for an IMS, said, "I'm just going to hunker down until it goes away."

During this same time, two or three of the Department staff members conducted meetings at all the state colleges and universities. The purpose of these meetings was to explain to teacher educators the IMS concepts and to elicit their support by incorporating these concepts into teacher and/or administrator training programs. We also held a day-long meeting in Jefferson City for teacher educators to inform them of our proposed emphasis on IMS. This meeting was attended by 87 college and university professors.

These efforts have had mixed results. Relatively few teacher educators have provided thorough training in outcome-based or mastery learning practice; still fewer have incorporated these concepts into their own classes. Teachers, for the most part, find the development of an IMS or organizing for mastery learning quite difficult. The demand for technical assistance is high. Even teachers who have recently completed their training (whether in Missouri institutions or in institutions of other states) feel inadequate when it comes to instructional alignment. They are unaware of the subtleties of directing instruction toward the outcome assessment. This has not been demanded of them nor taught in teacher training. Teachers' experience and training has often resulted in expectations that instruction causes a normal distribution in student achievement when the exact opposite of this is a major premise of an IMS.

To address this need for inservice training, Department staff have conducted three or four week-long IMS workshops each summer at state universities for graduate credit. Enrollment at each workshop has been limited to 100. Applicants exceeding this number have been turned away at nearly every scheduled workshop. Most of the workshop participants have come as local school district teams. Enrollment fees, paid by local districts or by individuals, have paid the costs of these workshops. In addition, during the school years since 1981, many local district staff development workshops have been conducted by the Department staff.

The Board and Department staff have also tried to build public awareness and understanding of the IMS concept. In recent years, for example, the Department has conducted an annual series of 10 "Regional Educational Conferences" in order to provide a forum for public discussion of a current educational issue. Each fall these meetings have attracted about 5,000 Missourians, including citizens, school board members, community leaders, parents, students, legislators and school district personnel.

The meetings include large-group presentations by state education officials, small-group discussion sessions for participants, and an opportunity for participants to express their views on current topics. During 1981 and 1982, the Department's Regional Conferences focused on instructional management and outcome-based education. The same topic was featured two consecutive years to emphasize the importance of these issues and to demonstrate a state-level commitment to the goal of promoting outcome-based education in all public schools.

To accelerate the change from a textbook driven curriculum to an outcome driven instructional program, the Department has established six networks of school districts committed to outcome-based education.

All school districts in the state were invited to become network members. Each participating district was asked to:

(1) involve the entire district or at least one building at each level (elementary, junior/middle, or senior high) in implementing an outcome based education program;

(2) agree to support financially teacher attendance at a one-week summer workshop and four all-day Saturday meetings for the upcoming school year and for the 1990-91 school year; and

(3) confirm its commitment by completing a proposal form signed by both the superintendent and the president of the local board.

Forty-one districts responded adequately and were accepted as network members. Each was assigned to one of six networks organized geographically around the State.

The Department's commitment is to provide outstanding educational experts and leaders in the field of outcome based education to conduct the week-long workshops and to meet with teachers on the scheduled Saturdays during the two school years. The Department's curriculum consultants and other staff members are also committed to providing ongoing follow-up and technical assistance to the schools.

The first round of workshops is currently in progress. The workshops are being conducted by Dr. Jim Block of the University of California - Santa Barbara; Dr. Alan Cohen and Dr. Joan Hyman, University of San Francisco; Dr. Tom Guskey, University of Kentucky; and Dr. Robert Burns of the Far West Regional Educational Laboratory.

The more than 450 participating teachers are not only implementing outcome-based education in their respective districts; they are also being trained to be expert trainers for other teachers.

Further impetus toward an outcome-based approach to learning was provided by the 83rd Missouri General Assembly. In 1985 the legislature passed House Bill 463, the "Excellence in Education Act of 1985." This Act dealt with all aspects of education simultaneously from teacher training and certification to curriculum standards and testing for students. Following is the complete text of Section 4 of the Act, which has provided a framework whereby efforts to implement an IMS could be accelerated across the state:

H.B. 463

SECTION 4

(Emphases added.)

1. The commissioner of education shall direct the department of elementary and secondary education to insure that all school districts have a program of pupil testing which shall test competency in the subject areas of English, reading, language arts, science, mathematics, social studies and civics.
2. The department of elementary and secondary education shall identify key skills within the subject areas contained in subsection 1 of this section which shall provide the foundation for the local school district's testing program. The department of elementary and secondary education may not set maximal testing standards.
3. Each local school district shall have a testing program. District testing programs may include minimum promotion standards and shall give due consideration to the research on the influence of cultural diversity on testing performance.
4. The testing program of each local school district shall include, but shall not be limited to, criterion-referenced tests approved by the department of elementary and secondary education. This testing program shall test all students at periodic grade levels. The testing program may test students and shall identify areas for instructional improvement. The department of elementary and secondary education may develop criterion-referenced tests and assist districts with their testing programs upon the district's request.
5. The department of elementary and secondary education shall develop or select tests which measure student performance on minimum key skills, and shall annually administer such tests to a randomly selected, statewide sample of public school students.
6. Each local school district shall provide testing

information upon request to the department of elementary and secondary education.

7. The department of elementary and secondary education shall annually report to the general assembly composite pupil testing information.

Developing Core Competencies/Key Skills

As soon as it became apparent that the Excellence in Education Act would pass and be signed into law, the Commissioner of Education appointed an Oversight Committee. This committee consisted of more than 100 persons representing all professional education organizations, labor leaders, agriculture and business leaders and legislators. After sharing DESE proposed plans for implementing Section 4 of H.B. 463 and receiving several suggestions from members of the Oversight Committee, statewide committees of teachers, subject area specialists and school administrators were appointed to recommend the "core competencies and key skills" to meet the mandate of the law.

Several critical decisions were made before the key skills were selected:

1. The decision was made to start at grade 10. This is generally the end of the "common core" curriculum experienced by all students. In addition, we decided to list as "key" those skills in each subject area which would undergird any elective courses a student might choose at grades 11 and 12. Finally, the tenth grade was selected because most of the high school dropouts in Missouri occur during grades 11 and 12. Thus, we could test a greater percentage of students than if we waited until grade 12 to test.
2. We decided to "work down" from grade 10. What does a student need in grade 9 as prerequisite to doing well in grade 10? What in grade 8?, etc.
3. Another decision was made to go only as low as grade 2 in the list of core competencies and key skills. Grade 1 skills were to be listed along with those for children

ages four through six. These are now being developed.

4. It was also decided that we should include important outcomes that cannot be measured by a paper/pencil test in the key skills list. These would, of necessity, be assessed locally.
5. Because the legislation calls for testing of a statewide sample of students at "periodic" grade levels, we chose to prepare tests for grades 3, 6, 8 and 10 first.
6. Student writing would be assessed each year on a sample of students at grades 6, 8 and 10. Holistic scoring would be done, for the state sample, by teachers who have been trained in this approach of assessing writing.
7. These tests would not be "grade level" tests in the usual sense of the word. They would not only measure what had been taught the year the test was taken, but they would also sample those skills, competencies and knowledge that a student had <u>accumulated</u> as of early April each year. This was done to spread accountability for student learning beyond the individual teacher and to include the building administrator/s. How well is the principal managing the resources in his/her building to assure every student a quality school experience?

More than 300 educators, from primary grade teachers through college professors, were involved in developing Missouri's key skills. Our "Core Competencies and Key Skills" (formally published in the fall of 1986 and revised in 1989) do not include <u>all</u> that should be learned through grade 10. Instead, the state list is a skeleton for local districts to "flesh out" as they see fit. The skeleton analogy is rather appropriate since everyone's skeleton is very similar when viewed in an x-ray. It is only when the necessary flesh and blood are added that the individual personal characteristics make us individuals. This allows for much local curriculum autonomy. Also, a skeleton is connected from the "toe bone" to the "head bone;" similarly, our key skills are also vertically articulated.

Several other concepts that research has demonstrated as adding to the "effect size" of achievement gains have been

incorporated into Missouri's plan for achievement gains:

1. The key skills were developed to build sequentially the concept of "enhanced prerequisites." (Leyton, 1983) If the teachers of sequential courses agree on the prerequisites needed for the subsequent course in a specific school subject, then each teacher of the first course can insure that by the end of the term most of the students have mastered these prerequisites before going on to the subsequent course in the subject.
2. The importance of home participation and support and that of enhanced cues and reinforcement through frequent feedback are stressed. Learner outcomes and mastery criteria are clearly spelled out before instruction begins. Both the student and his/her parents are provided this information. After initial instruction and the first formative test the student is provided feedback as to what he has learned well and what he still needs to work on. This coupled with the mastery learning process has been shown to have a possible effect size of two sigma. (Tenenbaum, 1982)
3. Teaching for higher order thinking has been shown to add to the total effect size, also. (Mevarich, 1980) Cognitive psychologists have classified more than half of the core competencies/key skills as being above the level of "comprehension" on Bloom's Taxonomy of Educational Objectives. (Bloom, 1956)

The Missouri Department of Elementary and Secondary Education sponsored two major statewide conferences: "Beyond Effective Schools" in 1986 and "Beyond Effective Schools II" in 1987. These were planned to let school district teams learn more about mastery learning, cooperative learning and OBE. Major presenters at these conferences have been Carol Barber, James Block, John Champlin, Alan Cohen, Thomas Guskey, David Johnson and Susan Loucks-Horsley. Care was taken to have each of these presenters come to the Department for pre-conference consultation to insure that the focus of the conference was sharp and clear. Several of these speakers have returned to the State after the meetings to provide workshops in their area of expertise.

Draft copies of the proposed Core Competencies and Key Skills were distributed and discussed at fourteen regional curriculum conferences across the state which were attended by more than 4000 teachers and administrators during the fall, 1985. Suggestions obtained at these meetings were incorporated in the final draft of the skills.

As the Core Competencies/Key Skills were being refined, the DESE met with representatives from every major test publisher in the United States to see if their firms could get tests developed which would meet Missouri's needs. There were two important reasons for DESE to reject all proposals by commercial testing companies to produce the tests: first, the items in their item banks which they showed DESE were almost all at the level of simple recall or memory and, second, the testing company representatives were so indoctrinated with the psychometric model of testing (normal curve as a design target) that they all proposed embedding a norm referenced set of items in the tests. The first design shortcoming violated the concept of curriculum and instructional alignment and the second was not consistent with the goal of mastery for all students. The DESE was committed to developing talent as opposed to selecting talent.

Developing the Tests

When the Department decided to develop its own tests, which were to be called the Missouri Mastery and Achievement Tests (MMAT), a contract was negotiated with the Center for Educational Assessment (CEA) at the University of Missouri, Columbia, to assist in organizing, developing, refining and finally, providing test scoring and reporting strategies.

Insert Figure 1 about here

A test development effort such as this requires large numbers of individuals to complete specified tasks at each stage of test development. While many individuals were involved in developing the MMAT, the groups described below were formally identified to

perform the functions indicated.

Widespread involvement of Missouri educators ensured that the tests were crafted with a firsthand knowledge of the state's school children and a special sensitivity to the educational growth of its young people. After the test objectives were determined, creation of the test battery itself required contributions by hundreds of Missouri educators at every level and scrutiny and revision of numerous drafts by CEA and the Missouri Department of Elementary and Secondary Education.

More than 200 teachers and administrators from schools throughout Missouri were involved in item writing. Another group of more than 200 teachers reviewed the items written by their colleagues for agreement with the Key Skills and for quality of the item stem and its choices. Teachers and administrators were involved in every phase of test development. In addition, a sample of students who had participated in the field trials was interviewed with structured-interview protocols to assess which features of the items had prompted their responses.

Consultants from the Department of Elementary and Secondary Education were involved with test development at all stages. Department consultants worked with CEA staff, teachers, and administrators in defining test content and in item writing.

The CEA staff supplemented its expertise with numerous consultants who worked on specific aspects of test development. A panel of five testing experts from across the country served as the Technical Advisory Committee and provided input on issues concerning test construction, scaling, equating, norming, item analysis, reliability, and validity. Members of that panel have participated individually in completing specialized tasks and studies during test development. A nationally recognized specialist in sampling design devised the sampling plans employed in this effort. A number of individuals examined items for bias. In short, CEA utilized the skills of no fewer than 20 nationally recognized individuals to amplify its professional efforts. Finally, since state officials and leaders in business, industry, and education were involved as an Oversight Committee during the implementation of the Excellence in Education Act of 1985, the

implementation of the Act was addressed by utilizing the services of the broadest sampling of the community involved in education.

A committee composed of 12 professors, three each from reading, social studies, mathematics, and science, wrote content specifications for test items for each of the 688 skills in both phases of development. Particular skills were assigned according to an individual's content or curricular expertise. The professors were instructed to elaborate, interpret, and clarify each key skill so that its particular characteristics might be clearly and uniformly understood by everyone involved. These elaborations formed the initial draft of the test content specifications.

Practitioners Develop the Test Items

Next, approximately 220 teachers from all grades throughout Missouri were assembled to review and further refine the specifications drafted by the college content area specialists. Workshop participants were charged with reviewing specifications in terms of their applicability to classroom instruction. Teachers met in groups of five to seven for each grade level and for each content area. Curriculum consultants from the Department of Elementary and Secondary Education assisted the teachers in reviewing specifications. The reviewers' comments and the exemplary items they produced were compiled to describe each skill according to content domain and grade level.

This version of the test content specifications was then reviewed by the college content area specialists. CEA editorial staff and Department consultants additionally reviewed and revised the specifications. Finally, each test content specification was reviewed by Department consultants and two to five teachers for specific content at a particular grade level. In total, more than 1,000 reviews of test content specifications had occurred by the time they reached their final form. The final test content specifications were then printed and distributed to all school districts in Missouri. Many teachers use the specifications in preparing lesson plans.

A test item writing workshop was then conducted. As with the Test Specifications Conference, teachers were grouped according to their subject areas and grade levels. Test specifications for the grade level and the content area were available to each group.

Two test item construction experts taught participants techniques of item writing during the workshops. In addition, consultants for the Department and from CEA worked closely with the teachers.

Hundreds of test items obtained from public domain item banks were available to item writers during the workshop. The teacher/authors decided that these items were not appropriate for assessing the Key Skills, and that the content of the items themselves was not suitable. The items were abandoned in favor of developing original items referenced directly to the test content specifications and Key Skills.

By the close of the workshops, 12 to 16 items for each of the 688 test content specifications had been developed. This translated to approximately 9,600 items.

Another group of approximately 240 teachers reviewed the items. Content specialists, including college professors, teachers, private consultants, curriculum consultants from the Department, and the CEA staff, reviewed the items. This process provided at least five reviews per item. Each systematic review required the use of a scorecard which included specific criteria relating to congruence between item and the key skill, appropriateness of the reading level for the grade level, wording, format, and appropriateness of distractors. These reviews were analyzed and the results were synthesized by CEA editorial staff and curriculum consultants from the Department of Elementary and Secondary Education. Modifications of particular items were made when appropriate. In some instances, these exhaustive reviews resulted in the removal of test items from further consideration.

Studies of the readability of items were completed by a reading specialist using standard formulas such as Flesch, Dale-Chall, SMOG, and FOG. For grades 2 and 3, a panel of 15 classroom teachers reviewed the test items and the directions to

ensure that the syntax and vocabulary would be understood by children of this age.

Item bias reviews, both judgmental and empirical, were undertaken. A panel with nationally accepted expertise in test item bias judged items for bias. Approximately 150 classroom teachers were asked to rate items systematically with specially constructed rating sheets to point out stereotyping or other objectionable wording which might bias items. Each item was rated approximately five times by classroom teachers who examined how each item might affect the way a child with a culturally or linguistically different background might respond. For each bias review, clearly delineated criteria were used. Items identified as biased were either discarded or flagged as needing editorial repair. Additionally, CEA editorial staff adjusted items to ensure a mix of genders in the name references in items, a mix of traditional and non-traditional gender roles, and a variety of ethnic backgrounds.

The initial test item pool contained approximately 9,600 items. The text alone for each phase required some 70,000 lines. More than 800 galleys were set. Five graphic artists completed approximately 3,000 graphics for the items. Just under one-third of the items required graphics, and a large number required text to accompany items.

This exhaustive process of item development, review, and revision has resulted in a pool of items of exceptional quality. The language of each item had been clarified; its congruence to a specific skill had been verified, and its ability to be understood by students had been examined. Several of the guiding principles which insured the quality of the resulting test include:

- Field participation. Teachers and subject area consultants established the content validity of the test.
- Expert judges. Curriculum and measurement authorities reacted to each stage of the test development and field trial techniques.
- A common-items equating design was used to ensure that the final forms for each level were indeed parallel.

The final version of the MMAT consists of four forms of

thirty-four criterion-referenced tests which assess student performance on Key Skills in grades 2 through 10. The grade 2 tests cover Language Arts/Reading and Mathematics. Subject tests for grades 3 through 10 include Reading/English/Language Arts, Mathematics, Science, and Social Studies/Civics. The battery consists of multiple-choice items with four options each. There are two parts to each of the subject tests; this allows students to be given a rest break during each subject test.

Using the MMAT to Test School Improvement

In the Spring of 1987, approximately 240,000 students in grades 3, 6, 8, and 10 were administered Form A. In the Spring of 1988, approximately 240,000 students in grades 3, 6, 8, and 10 were administered Form B and approximately 200,000 students in grades 2, 4, 5, 7, and 9 were administered Form D. During the next two years more than 83 percent of Missouri's students are scheduled to take the MMAT in grades 2 through 10; the remainder are giving the test to the required minimum of four levels.

The tests are administered in early April, scored, and the reports are returned to schools during the last two weeks in May before school is out for the year.

Local school district reports include the following:

1. Individual student report.

   This report lists, by subject, the Key Skills mastered and those not mastered, the student's scale score (on a scale of 100-500) and the district average scale score for that grade and subject

   The scale score of 300 was arbitrarily set to reflect the state average performance for 1987. A sample of schools representing rural/urban, large/small, high SES/low SES was randomly chosen (more than 5,000 students per grade level) and the same sampling process is used each year to obtain the State sample.

2. Individual Student Score Labels are supplied to be affixed to the student's permanent record.

   The ITBS and the TAP are administered each year to

the State's Sample to provide comparable national percentile ranks. This also allows the State to provide Chapter I eligibility lists to each district. This label lists the student NCE.

3. Pupil List Report.

   This report lists all students, by grade and subject, in a school building with mastery/non-mastery of each Key Skill indicated.

4. Grade Level Key Skill Report.

   This report presents the percentage of students mastering each Key Skill. There is a separate Grade Level Key Skill Report for each subject for a grade in a building and in a district.

5. Grade Level Cluster Report.

   This report depicts in graphic form the performance of students in a specific building or a district. Each "x" corresponds to the average scaled score of the Students in a building or the district at that grade on a subject or cluster. The bar extending through the "x" represents the standard deviation and shows the degree of variation among the scores.

6. Summary Report.

   This report provides information about an entire building's or district's performance at grades 2 through 10 on each subject tested on the MMAT. The Summary Report, when compared to previous years' reports, can be a useful tool for monitoring changes over time in MMAT performances.

7. District Summary Report by Quintiles.

   Quintiles for the State sample scores were established in 1987. This report displays what percent of students in a local district fall in each fifth of the state rankings established in 1987. This form is especially valuable to monitor progress toward equity in learner outcomes--which is a goal of OBE.

8. A school district may elect to receive other reports including summary data disaggregated by socio-economic

status, race, or sex, as well as output on computer diskette or tape.

The results of the 1988 and 1989 administration of the MMAT demonstrated that the Department's optimistic expectations were not misplaced. All of the state's sample showed gains. Obviously all of the more than 450 school districts in Missouri had not implemented all aspects of an IMS in all subjects and levels.

Insert Table 1 about here

The gains will more nearly approach what research has shown is possible as more districts adopt OBE practices.

There are three components to any effective accountability system:

1. There must be a clear set of desired outcomes;
2. There must be a feedback system so that one can know how well these outcomes are being achieved;
3. There must be consequences that matter.

It is obvious that we now had the first two requisites of an accountability system. To provide for consequences that matter, we invited school districts to volunteer to pilot the use of achievement data as a factor in school district classification. Prior to this time school classification in Missouri had been based upon inputs only. We sought at least ten percent of the districts to volunteer. This would have been 45 districts. Instead we had 109 districts with total enrollments of 185,000 which volunteered. Here is the reports of these 109 districts. There were about 15,000 students in each grade level reported. These districts reported gains of more than one sigma during this two year period in some cases.

Insert Table 2 about here

An even more crucial measure of how this entire process is bringing about improvement in the equity of student progress can be seen in the quintile reports. The State sample had exactly 20 percent of the students in each quintile in 1987 because that is

how the quintiles were established. Two years later we can see that a higher percent of students are in the higher one-fifth and fewer in the lower.

Insert Table 3 about here

The 109 "Academic Achievement Districts" made even more difference.

Insert Table 4 about here

There are two interesting observations about this table: These districts had nearly state average performance in 1987 and, second, they have quite high percents of students in the top two fifths and remarkably lowered percents in the bottom fifth. This is after only two years.

When one looks at the state sample (more than 20,000 students each year) and see statistically significant gains at all four levels and in each four subjects, the question arises: What caused these gains? Mastery learning and cooperative learning were only common practice in fewer than half the districts of the state. The only changed practice which was common to all schools was curriculum and instructional alignment. The mean scores in 1988 had moved far enough from the mean established in 1987 to cause a notable increase in the standard deviation from one year to the next in all cases. (Table 1)

During school year 1988-89 we began the process of reviewing and revising our Core Competencies and Key Skills. Every school in the state was given an opportunity to suggest changes and large committees of teachers were drafted to consider the suggestions and help revise the learner outcomes.

The same test development process that we used for the original test has been underway during the current school year. This time we are developing new forms for grades 7-10. Next year we will develop new forms for grades 2-6. The 7-10 test items will be field tested during the Spring and Fall of 1990 and will not be used officially until Spring 1991. The elementary grades

test forms will be introduced the next year.

Using the MMAT to Cause School Improvement

As students and teachers become more adept in outcome based instructional practice and as students experience more mastery learning and cooperative learning we should expect to see continued substantial gains in school achievement. The Core Competencies and Key Skills were reviewed and revised during 1989. Three new forms of the MMAT have been developed by teachers as the first forms were. These new test forms will be piloted and field tested during 1990 and used for the 1991 testing program. The new test forms are to be equated to the old forms to prevent any marked discontinuity in trend data.

Several lessons have been learned by Missouri's experiences in the quest for improved student learning:

1. Research-based practices which show educationally significant promise, such as outcome based educational decision making, mastery learning and instructional alignment, are the only practices that justify a major state effort.
2. The role of the State Board of Education and the Commissioner of Education is extremely important to successful statewide changes. Their long term public commitment to instructional management has been crucial to the gains made in Missouri schools.
3. The credibility and practitioner ownership of a process is positively related to the breadth of involvement of those most affected by the process.
4. Many change efforts fail because the novelty of the change wears off and because new ideas intrude before sufficient time is devoted to the original practice to see it successful. Focus over time is needed in staff development to equip school staffs to incorporate changes effectively.

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SUBJECTS AND CLUSTERS

Reading or English/ Language Arts	Mathematics	Science	Social Studies/ Civics
Language Arts	Understanding Numbers	Life Science	Geography
Reading	Computation	Earth Science	History
Writing	Measurement and Geometry	Physical Science	Government
	Interpretation and Application	Cross-Disciplinary	Economics
			Civics

Figure 1 -- Clusters of key skills included in the Missouri Core Competencies/Key Skills by subject area

Grade 3, Forms A, B and C Statistics
Spring 1987, 1988 & 1989 Administrations

Subject	Number of Items	Scaled Score: Means Forms: A	B	C	Standard Deviation Forms: A	B	C	IRT Reliability Forms: A	B	C
Reading	84	300	315	328	65	68	73	.948	.941	.933
Mathematics	68	300	318	323	65	77	74	.929	.916	.910
Science	64	300	311	344	65	72	79	.909	.895	.888
Social Studies	56	300	325	337	65	73	71	.924	.905	.904
n =		4789	5706	5378						

Grade 6, Forms A, B and C Statistics
Spring 1987, 1988 & 1989 Administrations

Subject	Number of Items	Scaled Score: Means Forms: A	B	C	Standard Deviation Forms: A	B	C	IRT Reliability Forms: A	B	C
Reading	92	300	308	321	65	72	70	.937	.937	.929
Mathematics	104	300	332	339	65	77	83	.955	.956	.959
Science	92	300	332	344	65	84	83	.914	.926	.926
Social Studies	84	300	321	322	65	77	78	.943	.942	.943
n =		5138	5152	4903						

Grade 8, Forms A, B and C Statistics
Spring 1987, 1988 & 1989 Administrations

Subject	Number of Items	Scaled Score: Means Forms: A	B	C	Standard Deviation Forms: A	B	C	IRT Reliability Forms: A	B	C
Reading	108	300	322	326	65	70	71	.951	.950	.946
Mathematics	100	300	336	335	65	84	84	.949	.953	.954
Science	72	300	337	345	65	88	82	.901	.906	.898
Social Studies	72	300	325	325	65	77	75	.941	.937	.934
n =		5346	4733	5258						

Grade 10, Forms A, B and C Statistics
Spring 1987, 1988 & 1989 Administrations

Subject	Number of Items	Scaled Score: Means Forms: A	B	C	Standard Deviation Forms: A	B	C	IRT Reliability Forms: A	B	C
Reading	112	300	315	324	65	72	76	.948	.940	.946
Mathematics	92	300	313	330	65	72	82	.951	.952	.956
Science	80	300	326	322	65	82	73	.891	.892	.887
Social Studies	100	300	314	311	65	70	72	.957	.952	.943
n =		5645	5023	4723						

Note - All gains are significant at the .0001 level from Form A to B; many are significant at the .0001 level from Form B to C.

Table 1 -- The standard error range is from .9 to 1.2

Academic Achievement Districts: 1987, 1988 and 1989

Subject / Grade	READING			MATH			SCIENCE			SOCIAL ST.		
	87	88	89	87	88	89	87	88	89	87	88	89
3	306	334	365	304	349**	365	307	335	418	314	340	393
6	298	323	350	303	379*	404	305	393*	416	304	358**	360
8	310	349**	353	317	387**	390	314	385**	412	314	362**	358
10	304	327	355	309	328	372	308	356**	356	305	329	328

First year gain data

* one sigma gain, sigma for the baseline (300) is approximately 65.

** gains from .56 to .83 sigma

Table 2 -- Scale score gains recorded for 109 Missouri school districts which volunteered to use achievement data as a school classification standard. These districts have total enrollments of 185,000 students. There were approximately 15, 000 totaled at each grade level.

MISSOURI MASTERY AND ACHIEVEMENT TESTS

ACADEMIC ACHIEVEMENT REPORT

State Sample 1988 and 1989

GRADE 3

	READ		MATH		SCI		SOC. ST	
	88	89	88	89	88	89	88	89
HIGH	28	35	30	32	26	44	32	40
	21	21	20	22	23	22	24	25
	18	17	18	18	16	13	18	16
	17	14	15	14	17	11	13	11
LOW	15	12	17	14	18	10	13	09

Number Tested 1988 - 5706
1989 - 5378

GRADE 6

	READ		MATH		SCI		SOC. ST	
	88	89	88	89	88	89	88	89
HIGH	24	30	36	39	37	43	32	33
	19	21	21	20	19	20	20	20
	19	19	17	16	15	16	16	17
	19	17	14	13	14	12	16	15
LOW	18	13	12	11	15	10	15	15

Number Tested 1988 - 5152
1989 - 4903

GRADE 8

	READ		MATH		SCI		SOC. ST	
	88	89	88	89	88	89	88	89
HIGH	31	33	40	39	38	43	34	34
	22	22	18	19	20	21	20	21
	18	18	16	15	15	15	17	18
	16	16	14	13	13	12	14	13
LOW	13	12	13	14	14	09	15	14

Number Tested 1988 - 4733
1989 - 5258

GRADE10

	READ		MATH		SCI		SOC. ST	
	88	89	88	89	88	89	88	89
HIGH	27	32	27	34	34	32	26	25
	21	20	21	22	20	21	22	20
	18	18	18	17	16	17	20	20
	17	15	17	15	13	15	17	17
LOW	16	15	17	13	16	15	16	18

Number Tested 1988 - 5023
1989 - 4723

Table 3 -- 1988 and 1989 percent of students scoring in each fifth established using 1987 data.

ACADEMIC ACHIEVEMENT DISTRICTS: 1987, 1988 & 1989, MMAT

GRADE 3

	READ			MATH			SCI			SOC. ST.		
	87	88	89	87	88	89	87	88	89	87	88	89
HIGH	23	40	55	25	45	54	24	38	77	27	38	70
	21	22	20	19	22	19	21	22	12	21	25	15
	18	16	12	19	13	13	19	16	5	17	19	7
	18	13	8	17	10	8	17	13	3	16	11	5
LOW	29	9	6	20	10	6	19	11	2	19	7	2

GRADE 6

	READ			MATH			SCI			SOC. ST.		
	87	88	89	87	88	89	87	88	89	87	88	89
HIGH	21	32	45	22	58	65	24	64	71	23	50	50
	20	20	21	19	20	16	20	16	13	20	20	18
	19	18	14	19	12	9	18	9	8	18	13	12
	19	17	12	18	7	6	18	6	5	20	10	10
LOW	21	13	8	22	3	4	20	5	4	19	7	10

GRADE 8

	READ			MATH			SCI			SOC. ST.		
	87	88	89	87	88	89	87	88	89	87	88	89
HIGH	25	45	47	28	60	60	27	59	69	28	50	50
	20	23	20	22	[illegible]	16	19	17	15	20	20	19
	20	15	11	19	11	8	22	11	4	19	13	12
	17	11	11	16	8	8	16	6	4	15	9	9
LOW	18	6	7	15	4	7	16	7	3	18	8	10

GRADE 10

	READ			MATH			SCI			SOC. ST.		
	87	88	89	87	88	89	87	88	89	87	88	89
HIGH	24	34	48	25	33	53	25	50	50	24	32	35
	21	20	17	21	22	19	21	18	19	21	22	19
	18	18	11	19	18	9	19	12	10	19	19	14
	19	16	11	15	17	9	17	9	10	18	10	14
LOW	18	12	11	18	12	8	18	11	9	18	12	16

Table 4 -- Average percent of students in each fifth of the distributions of the 109 "academic achievement" districts.