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AUTHOR Kacer, Barbara A.; Craig, James R.
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ABSTRACT

The Kentucky Institute for Educational Research has created six different Innovation Configuration Component (ICC) maps that describe the implementation of educational reforms in Kentucky in the context of the Kentucky Educational Reform Act. As part of a general study of progress toward educational goals in Kentucky, an investigation was conducted of the use of the ICC map to describe educational technology used in middle schools in Kentucky and, if the map could be used, the nature of the relationship between the level of implementation of educational technology and Kentucky's high-stakes assessment of academic achievement. Ten middle schools representing 5 levels of performance were followed longitudinally, and data from the ICC technology map compared with the results were of teacher interviews. In the sample of schools studied, there was a positive relationship between the degree of implementation of education technology in a school and achievement gains posted by the school's students, but it could not be determined whether the gains were a function of the implementation of the technology. The implementation of educational technology may be a marker of a school's willingness to implement reforms. Findings also suggest that another iteration of the ICC Map of Educational Technology would be appropriate to reflect the actual situation in the schools more accurately. (Contains 2 figures, 6 tables, and 12 references.) (SLD)

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Evaluation of Educational Technology in Kentucky Middle Schools

Barbara A. Kacer
School of Integrative Studies
in Teacher Education
Western Kentucky University

James R. Craig
Department of Psychology
Western Kentucky University

Paper presented at the annual meeting of the Mid-South Educational Research Association
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Introduction

The Kentucky Educational Reform Act (KERA) of 1990 is a massive education reform bill that specified many new initiatives to be developed and implemented to improve the system of public schooling in the state of Kentucky. The effectiveness of those initiatives has been evaluated in a variety of ways by different public and private organizations and individuals. One approach is to study the long term implementation/effects of the initiatives. The Kentucky Institute for Education Research, a private, non-profit research organization, has supported a three-year longitudinal study to investigate the education innovations being implemented in a small sample of middle and high schools across the state of Kentucky.

The Concerns Based Adoption Model (CBAM), a model of educational innovation and change described by Hall and Hord (1987), has been used in this and previous studies (Craig, 1997; Craig & Kacer, 1999; Craig, Kacer, & Evans, C.S., 1998; Craig & Pankratz, 1996) to provide the theoretical framework for the examination of the implementation of reform initiatives. One of the diagnostic tools used in CBAM to inform and describe the change process is termed an Innovation Configuration Component (ICC) Map. These maps are designed to specify the key components associated with an innovation and to define what "use" means in the context of implementing an innovation. Through the Kentucky Institute for Education Research, six different ICC Maps have been created (KIER, 1996a, 1996b, 1996c, 1996d, 1996e, 1996f, 1996g) to describe the implementation of education reform initiatives in Kentucky regarding:

- professional development of the school staff
- extended school services
- school-based decision making councils
- high school restructuring
- family resource and youth service centers
- educational technology
- the primary program

For example, on the ICC Map for Professional Development (KIER, 1995), several key innovation components have been identified (e.g., "Teachers have an individual professional growth plan.") The descriptive categories associated with this component are:

(a)	(b)	(c)	(d)	(e)
All staff have developed individual professional growth plans that integrate school goals and their professional career goals. Plans are part of a formal school process.	All staff have developed individual growth plans, and a process for integrating individual plans with school goals is in beginning stages.	Staff have developed individual growth plans, but the school has not integrated the process of individual growth plans into professional development.	School staff are encouraged to develop and submit individual plans to the principals or committee.	the school has not addressed the process of integrating individual professional growth plans.

Of the five categories associated with the individual growth plan component, category (a) is considered the ideal implementation description. In contrast, category (e) describes the least desirable implementation of the component with the other categories associated with other points on the continuum. Therefore, if through interviews and observations it is determined that category (a) best describes how the reform initiative of professional development operates in a school, then that school is considered to have completely implemented that particular component of professional development.

The maps serve as the basis for an interview (or interviews) with knowledgeable administrators and/or teachers and, in some instances, direct observation to gain information about the implementation of key features associated with particular KERA initiatives. Based on the interview(s) and direct observations (if any), the interviewer determines the degree of implementation of components associated with an innovation. An innovation profile or score total can then be determined for each school regarding each initiative.

Purpose

The general intent of the three-year longitudinal study has been to:

- Identify key factors that differentiate schools making progress toward achievement goals from those which are not
- Identify key factors that contribute to successful intervention in low performing schools and/or schools in crisis

The particular focus of the research effort reported here was two-fold. First, the intent was to assess whether the ICC Map for Educational Technology (KIER, 1995) developed by KIER could be effectively used to describe educational technology employed in instruction in middle schools in Kentucky and, second, if the map could be used, the nature of the relationship between the level of implementation of educational technology and the state's high-stakes assessment of a school's students' academic performances as reflected in the state derived Accountability Index (see Instrumentation below).

Sample

The sample that was being followed longitudinally consisted of ten middle schools from across the state of Kentucky. The schools sampled represent five levels of school performance based on the initial pattern of change from 1993 to 1995 of each school's Kentucky Instructional Results Information System (KIRIS) Accountability Index (see below) for students' academic performances. There levels were:

- Level 1. **(Schools Moving Up)** Schools with improving KIRIS scores which had baseline KIRIS scores in the upper quartile of all middle or high schools assessed.

- Level 2. **(Schools Not Moving Up)** Schools with no improvement in KIRIS scores which had baseline KIRIS scores in the upper quartile of all middle or high schools assessed.

- Level 3. **(Schools Moving Up)** Schools with improving KIRIS scores which had baseline KIRIS scores approximately equal to the mean of all middle or high schools assessed.

- Level 4. **(Schools Moving Up)** Schools with improving KIRIS scores which had baseline KIRIS scores in the lower quartile of all middle or high schools assessed.

- Level 5. **(Schools Not Moving Up)** Schools with no improvement in KIRIS scores which had baseline KIRIS scores in the lower quartile of all middle or high schools assessed.

The KIRIS accountability indices for the baseline and each year since 1993 for the ten middle schools in the sample as determined by the state are presented in Table 1; the average KIRIS Accountability Indices for each Level are presented in Figure 1. Because of a change in the state accountability system, a KIRIS Accountability Index will not be determined for 1998. Furthermore, the extent to which the schools as these various levels are representative of all middle schools in the state with similar KIRIS Accountability Index values is not known. School #3 declined to participate in the third round of data collection.

Table 1. The KIRIS Accountability Index values and initial performance levels for the ten middle schools sampled.

School	Level	Base	Index 93	Index 94	Index 95	Index 96	Index 97	Index 98*
1	L1	43.5	38.8	48.1	55.1	50.9	54.8	
2	L1	45.0	42.4	47.2	51.5	46.7	47.6	
3	L2	45.3	45.6	41.8	41.6	37.7	50.5	
4	L3	40.9	33.4	48.2	56.3	55.7	55.8	
5	L3	38.6	33.6	44.1	51.0	45.0	46.6	
6	L4	33.9	31.3	36.7	44.3	36.6	39.9	
7	L4	32.8	29.4	36.1	36.2	30.6	36.1	
8	L4	34.0	29.6	38.5	45.1	39.8	36.6	
9	L5	33.3	33.5	33.1	32.7	30.0	31.2	
10	L5	31.0	31.9	29.9	34.4	35.5	32.4	

*The KIRIS Accountability Indices were not calculated for 1998 by the Kentucky Department of Education due to changes in the state's accountability system.

School #3 declined to participate in the third round of data collection.

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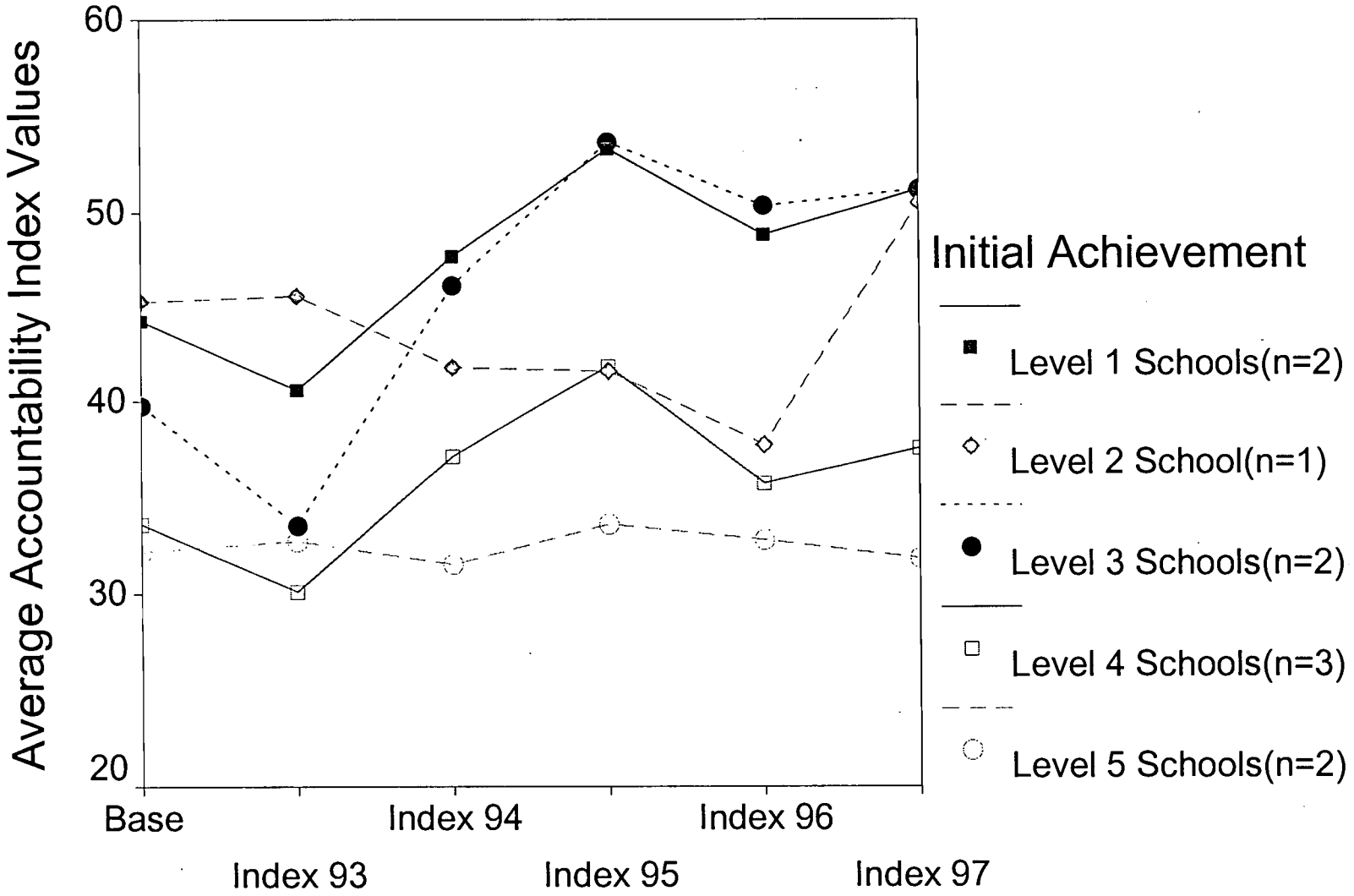
Figure 1. Accountability Indices for Middle Schools at Different Levels for Baseline to 1996-97



Instrumentation

The ICC Map for Educational Technology

First, an attempt was made to use the ICC Map for Educational Technology (KIER, 1996f) to assess the instructional use of technology in the middle schools. A copy of the map is not attached but an example of an item on the map is presented in Table 2. [The map is available from the Kentucky Institute for Education Research at the University of Kentucky in Lexington, Kentucky.] In general, the map proved to be too unwieldy to be employed effectively since it required much detailed information from a school's educational technology coordinator and/or principal regarding whole school use of technology. An example would be the item dealing with the integration of technology into the curriculum (refer to Table 2).

For reasons of expediency during the third year of the longitudinal study the researchers reduced the educational technology map to two questions from the original map (refer to Table 3). In the context of the longitudinal study, the data gained from those two map items were "informed" by teacher interview data gathered from teachers in the school regarding their use of instructional educational technology.

(KIRIS) Accountability Index

The state of Kentucky has developed the Kentucky Instructional Results Information System (KIRIS) to determine a school's Accountability Index (see below) for students' academic performances. [The system is currently undergoing revision and a new system for determining an accountability index for a school will be created.] In the past, a school's Accountability Index has been created by the state by combining the assessment of the academic achievement of students attending a school with several "non-cognitive" factors (e.g., drop-out rate) into one measure of a school's overall performance. The KIRIS Accountability Index values for schools are made generally available to the public by the Kentucky Department of Education.

B. Technology Integrated into the Curriculum [variety of applications, extent of integration]

Check all that apply

	(a) Technology is regularly integrated into the teaching and learning process for most students.	(b) Technology is regularly integrated into the curriculum for some students.	(c) Technology is occasionally integrated into the curriculum for some students.	(d) Technology is used by some students but not taught in the school curriculum.	(e) There is little or no integration of technology into the teaching, learning process of the school.
Word processing					
Analysis of data					
Spreadsheets					
Electronic databases					
Communication networks					
Data management					
Storage of information					
Multimedia production					
Curriculum-specific software					
Other_____					

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B. Technology Used in the Instructional Process
Circle the statement that most accurately applies.

1. Extent to which there is a technologically rich learning environment *[flexibility, extent of technology]*

(a)

Computers and other appropriate technology are located in areas that enable all students to have flexible access during instructional activities (this includes class work that may be occurring in labs). Students or groups of students can work in computer areas while other types of instructional activities occur. Students help each other.

(b)

Computers and other appropriate technology are located in areas that enable many (more than 2/3) students to have flexible access during instructional activities (this includes class work that may be occurring in labs). If students or groups of students work together in computer areas there is some disruption of other types of instructional activities. Students mostly help each other with some teacher assistance.

(c)

Computers and other appropriate technology are located in areas that enable only some (up to 1/3) students to have flexible access during instructional activities (this includes class work that may be occurring in labs). Students of groups of students can work in computer areas but this greatly disrupts other types of instructional activities. Teacher primarily helps students on the computers.

(d)

Computers and other appropriate technology are either not available at all or are located in an area that does not enable students to have flexible access during instructional activities. For example the classroom has only one computer located in the front of the room at the teacher's desk or the student computer(s) is located in the center of the room and using it might disrupt other activities etc. Students or groups of students can not work in computer area while other instructional activities are occurring. No help is given if a student is using the computer.

2. Extent of technology application in the instructional process *[variety of applications, integration into ongoing instruction]*

(a)

A variety of technology applications are regularly used as ongoing elements in the instructional process.

(b)

Several technology applications are regularly used as ongoing elements of the instructional process.

(c)

One or two technology applications are regularly used to support and enhance instruction.

(d)

One or two technology applications are occasionally used to support and enhance instruction.

(e)

Technology applications are seldom used to support instruction.

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Data Collection Procedures

During the third year of the longitudinal study, the education technology coordinators in nine of the middle schools in the sample were interviewed on site using the modified ICC Map for Educational Technology. In most instances, facilities were observed as part of the interview. One middle school (a Level 2 school) declined to participate in this round of data collection.

Findings

Education Technology

The modified ICC Map for Educational Technology is scored from 4 for Category (a) to 1 for Category (d) for Item #1 and from 5 for Category (a) to 1 for Category (e) for Item #2. Therefore, the education technology implementation scores vary from a maximum of 9 (4 for Item #1 and 5 for Item #2) to a minimum of 2 (1 for Item #1 and 1 for Item #2). The data for the middle schools sampled are presented in Table 4. It is noteworthy that the highest scoring school (i.e., School #3 which received a 9 on the map) is not a high socioeconomic school. However, the district has dedicated the resources necessary to wire the school for a computer network and Internet access, provide enough computers to meet the state guidelines ratio of one computer for every six students, provide a good library of video materials (tapes and disks) and sufficient video equipment, provide necessary scientific equipment for the science curriculum, and so on. In addition, almost all of the teachers in the school regularly include the use of word processing, use of the Internet, and spreadsheets in teaching all content areas across the curriculum. In contrast, in School #8, which scored a 3 on the modified ICC Map for Educational Technology, teachers are generally bound to using print materials in their instructional activities. Generally, they feel this is necessary in order to keep it simple so students can learn the basic skills they need. The teachers at School #8 do not seem to be interested in incorporating much technology, especially computer technology, into the curriculum. While there is a computer in each classroom for teacher use, they are rarely, if ever, used for student instruction. The library in School #8 has a reasonable collection of print, video, and audio materials and equipment and provides access to the Internet for student research. The building has not been wired and physically adapted to integrate computer or other technologies into the building's physical plant.

Table 4. School educational technology map implementation score and associated comments for the middle schools sampled.

School #	Education Technology Implementation Score*	Comments
1	7	Has professional development for teachers on educational technology during teacher planning periods during the school day.
2	4	Has reasonable technology resources in the school for teachers; very uneven use of technology among the teachers across the school.
3	8	Several classes are technology based.
4	9	Has a technology rich environment; teachers worked collectively to incorporate technology into the school's curriculum.
5	3	Teachers have to be trained in the use of technology and to be encouraged to incorporate technology into the curriculum.
6	8	Makes an effort to use technology in the extended school services program.
7	4	Has a great computer laboratory set up & the principal has a plan; working to incorporate technology into the curriculum & are about 2-3 years away.
8	3	Teachers are focused on "basics" & are not into technology; school needs to be physically technologically updated.
9	3	Several teachers are positively motivated to incorporate technology into their classrooms but the technology available is old & is a general state of disrepair.

*The higher the Education Technology Implementation Score, the closer the implementation of the innovation is to what is considered ideal.

Student Achievement

The achievement of the students in a school is reflected in a school's KIRIS Accountability Index as determined by the state. The gain or loss of the ten middle schools' accountability indices is presented in Table 5. Some schools posted significant gains over the period (e.g., School #4 gained 22.4 points in its Accountability Index) while others showed losses (e.g., School #9 lost 2.3 points) or very minimal gains (e.g., School #10 gained .5 points).

Table 5. Gain or loss in a school's KIRIS Accountability Index from 1993 to 1997.

School	Level	Index 93	Index 97	Index 97- Index 93 Gain (Loss)
1	L1	38.8	54.8	16.0
2	L1	42.4	47.6	5.2
3	L2	45.6	50.5	4.9
4	L3	33.4	55.8	22.4
5	L3	33.6	46.6	13.0
6	L4	31.3	39.9	8.6
7	L4	29.4	36.1	6.7
8	L4	29.6	36.6	6.0
9	L5	33.5	31.2	(-2.3)
10	L5	31.9	32.4	.5

Relationship between Accountability Index Gain(Loss) and Educational Technology Implementation Score

The relationship between a school's Accountability Index gain (or loss) over the five year period from 1993 to 1997 and a school's education technology implementation score as determined by the modified ICC Map for Education Technology was examined via a rank-order correlation. Even though the sample size was small, the correlation was found to be positive and significant ($rho=.693$, $p<.05$). The relationship is visually depicted in Figure 2.

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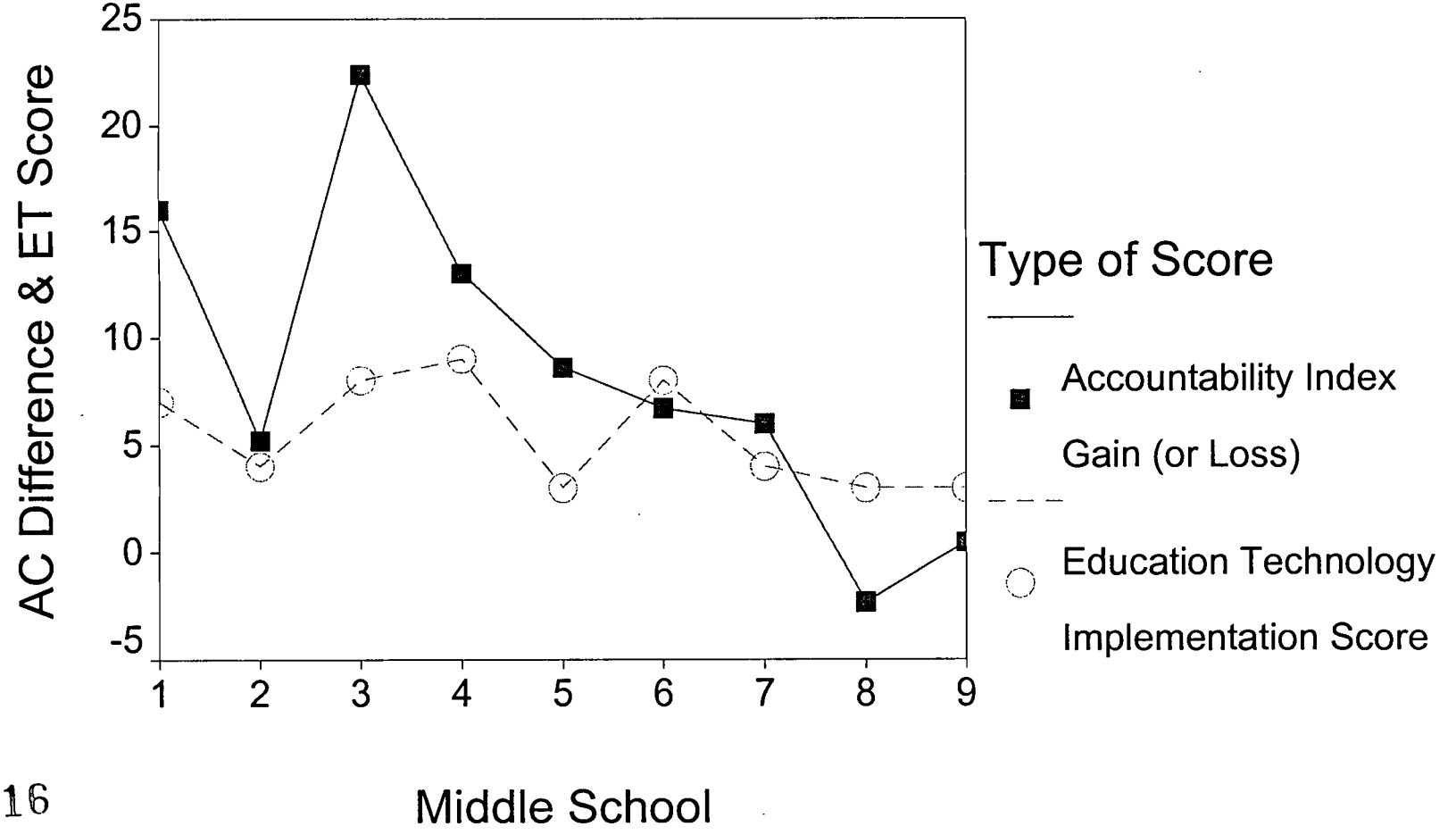
Figure 2. The relationship between a school's Accountability Index gain (or loss) and education technology implementation score (rho =.693)



Discussion

At least in the small sample of middle schools studied, there is positive relationship between the degree of implementation of education technology in a school and the achievement gains posted by the school's students. However, it is not known if the gains are directly a function of the implementation of education technology in a school or simply associated with the attitudes and teaching behaviors of teachers in middle schools which have a high degree of implementation of education technology. It is possible that the degree of implementation of education technology in a school is a barometer of a school's general willingness to implement the a particular KERA reform initiative and not a function of education technology per se.

The findings also suggest that another iteration in the formulation of the ICC Map of Educational Technology is appropriate. Additional information regarding a school's implementation of education technology would be helpful in better understand the relationship, if any, between degree of implementation of education technology in a school and the achievement gains posted by the school's students. Therefore, the researchers have produced a third ICC map to assess the use of educational technology in instruction in middle schools. A copy of this map is contained in Table 6. Its key features include components that address the infusion of educational technology into the curriculum and its impact on assessment.

TABLE 6

ICC Map for Assessing Educational Technology Use in a Middle School

1. Extent to which knowledge of and skill in the use of keyboarding is an educational objective for all students.

a	b	c	d
All/most students are taught keyboarding at a proficient level.	Some students are taught keyboarding at a proficient level.	A few students are taught keyboarding at a proficient level.	Students are not taught keyboarding.

2. Extent to which knowledge of and skill in the use of spreadsheets is an educational objective for all students.

a	b	c	d
All/most students are taught spreadsheets at a proficient level.	Some students are taught spreadsheets at a proficient level.	A few students are taught spreadsheets at a proficient level.	Students are not taught spreadsheets.

3. Extent to which knowledge of and skill in the use of word processing is an educational objective for all students.

a	b	c	d
All/most students are taught wordprocessing at a proficient level.	Some students are taught wordprocessing at a proficient level.	A few students are taught wordprocessing at a proficient level.	Students are not taught wordprocessing.

4. Extent to which knowledge of and skill in the use of the Internet is an educational objective for all students.

a	b	c	d
All/most students are taught how to use the Internet at a proficient level.	Some students are taught how to use the Internet at a proficient level.	A few students are taught how to use the Internet at a proficient level.	Students are not taught Internet skills.

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5. Computer technology instruction is accomplished in a laboratory environment where each classroom teacher participates in the instruction along with the students (i.e., it is not a "drop off" arrangement).

a	b	c	d
In most instances the teachers participate in the instruction along with the students.	In some instances the teachers participate in the instruction along with the students.	In a few instances the teachers participate in the instruction along with the students.	Teachers do not participate in the instruction along with the students.

6. Technology is not defined as just computer use but also includes a rich environment of other forms of technology used for instruction (i.e., video discs, video and audio tapes, scientific equipment, etc.

a	b	c	d
A variety of technology applications are used regularly as ongoing elements in the instructional process.	Several technology applications are used regularly as ongoing elements in the instructional process.	One or two technology applications are used regularly to support and enhance instruction.	Technology applications are seldom used to support instruction.

7. Teachers use and build upon keyboarding, spreadsheets, word processing, and Internet knowledge and skills by incorporating their use into regular classroom instruction and learning environments. (INSTRUCTIONAL CHANGE)

a	b	c	d
All/most teachers do.	Some teachers do.	A few teachers do.	Teachers do not do this.

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8. The extent to which teachers/the school has/have modified the curriculum in response to advances in technology. (CURRICULAR CHANGE)

a	b	c	d
All/most teachers and the school as a whole have modified the curriculum.	Some teachers and some aspects of the school have modified the curriculum.	Few teachers have modified their curriculum. Curricular changes are not at the school level.	The teachers/school have not done this.

9. The extent to which assessment practices have changed in response to technology.

a	b	c	d
Assessment practices have changed significantly.	There is some evidence that assessment practices have changed.	There is little evidence that assessment practices have changed.	There is no evidence that technology has impacted assessment practices.

10. The extent to which technology supports student diversity.

a	b	c	d
All/most teachers and the school as a whole actively use technology to accomodate student diversity.	Some teachers and some aspects of the school actively use technology to accomodate student diversity.	Few teachers use technology as a tool to accomodate student diversity. Technology has had minimal impact on the way the school as a whole accomodates student diversity.	There is no evidence that technology is used as a tool for accomodation of student diversity.

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