

**Meeting the Challenge of NCLB with Technology: Initial Findings from the NC
IMPACT Statewide Evaluation**

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Abstract: The William and Ida Friday Institute for Educational Innovation, located on the Centennial Campus of North Carolina State University, serves as a dynamic setting for conducting research aimed at providing improved approaches to teaching and learning in technology-rich environments. The Friday Institute is a partner in a statewide evaluation project in which technology integration is systematically implemented based upon a model created by the NC Department of Public Instruction. Eleven schools employ the IMPACT model of technology integration in which personnel, staff development, hardware, and software are funded at sufficient levels. The role of the Friday Institute is to evaluate the effectiveness of this model.

Introduction

The successful integration of technology into teaching and learning has been the goal of educational institutions for some time. With significant technology investments comes the expectation for increased student achievement and computer skills that will serve them well in our increasingly technological society (Anderson, 1999, Hancock & Betts, 2002). The need for 21st-century skills creates a critical demand on students to acquire and practice the higher-order thinking skills of analyzing, synthesizing, and evaluating as presented in the advanced levels of Bloom's Taxonomy (Porter, 2003). While much funding has been used in schools to purchase technology and the supplemental resources needed to implement it successfully, there is yet not enough evidence to support whether or not it has improved student behaviors and achievement significantly. Student achievement is the bottom line for many school administrators.

Several studies report that using technology does have a positive impact on student learning (Cradler et al., 2002, Ciesemier, 2003, Cramer & Smith, 2002, Middleton & Murray, 1999, Lou et al., 2002, Latham, 1999). In a West Virginia study of 950 fifth graders an increase in test scores in reading and mathematics as measured on the SAT-9 were found resulting from integrating curriculum objectives with instructional software (Mann et al., 1999). Wenglinsky (Cradler, McNabb, Freeman, 2002) analyzed data from the National Assessment of Educational Progress (NAEP), a national database of student test scores, to determine the effects of technology use on mathematics achievement for fourth and eighth grade students. He found that there were positive effects at both levels. With the accountability requirements of NCLB as well as the budgetary limitations today, it is imperative that money be spent most efficiently to effect student behaviors and outcomes.

Many times technology funding has been used to fund specific aspects of instructional technology implementation rather than ensure that all of the necessary components for implementation are present. Throughout the years many states have funded specific aspects of technology implementation, but have not funded all of the elements identified through research as being needed for a successful implementation. The inclusion of all of the elements would more likely lead to successful long-lasting results. Hardware, software and infrastructure have been supported through a combination of internal and external funding in the past while schools systems struggle independently to support the personnel necessary to implement technology integration. The promise of the IMPACT Model is the complete implementation of technology

integration to support student learning by including all the components required for success.

Objectives and Purpose

The research presented is funded through the Enhancing Education Through Technology portion of No Child Left Behind (NCLB). The purpose of this research is the statewide evaluation of the IMPACT program intervention in our North Carolina schools as mandated by NCLB.

The external evaluation team is affiliated with The William and Ida Friday Institute for Educational Innovation, North Carolina State University. The team will determine to what extent the implementation of the IMPACT model, based on state and national standards and guidelines, makes a difference in student achievement.

Significance

The study covers a three-year period (2003-2006) in 11 North Carolina schools selected to implement the IMPACT model with full funding. Quantitative measures and qualitative methodology in the longitudinal design will be used to explore the effects of the IMPACT model of technology integration on the student, teacher, and administrator variables.

A matched-pair quasi-experimental research design is utilized where nonparticipating schools that are similar in important characteristics (size, SES, rurality/urbanicity, etc) are compared on key variables to IMPACT schools to determine if changes observed over time are due to the IMPACT program or other environmental or historical factors.

Questions to be addressed include:

- Does IMPACT have an effect on student behavior and outcomes?
- Does IMPACT have an effect on teacher behavior and outcomes?
- Does IMPACT have an effect on administrator behavior and outcomes?

The findings of the research may have a future influence upon how technology is integrated in schools across North Carolina and throughout the country. The findings will inform technology integration, student achievement, and NCLB mandates.

Theoretical Framework

The IMPACT model and grant is based upon the premise that well-staffed and funded media and technology programs can increase student achievement.

The IMPACT grant funds a full-time instructional technology facilitator, a full-time media coordinator, hardware, software, infrastructure, staff development, and technical support to provide adequate saturation and penetration of technology for teachers to use it comfortably and competently in their classrooms.

The primary hypothesis is that the implementation of the IMPACT model of integrating technology into teaching and learning will make a significant difference in student achievement based on North Carolina End-Of-Grade test scores and other measures as needed.

Also tested are the IMPACT model's effects upon the following student outcomes:

- Achievement, as measured by End-Of-Grade (EOG) tests and other appropriate measures
- Student attitudes toward computer-related technology and its use for academic purposes

- Student's critical thinking and problem solving skills
- Student behavior, truancy, dropout rates

The IMPACT model's effect on the following teacher outcomes will be tested:

- Methods of teaching, including student-centered learning
- Attitudes toward computer-related technology and its use for academic purposes
- Teacher retention
- Integration and utilization of technology in the classroom, both in quantity as well as quality
- Student-teacher interactions and relationships from both the student and teacher perspectives.

We will also assess the extent to which other variables affect the success of the IMPACT model such as leadership style, school population characteristics such as socioeconomic status, racial balance, and composition, etc., and administrator attitudes toward computer-related technology and its use for academic purposes.

IMPACT Model

The North Carolina Department of Public Instruction has developed a document outlining standards for instructional technology implementation, which addresses all of the components for a successful program. Impact: Guidelines for Media & Instructional Technology Programs provides standards for school personnel to follow in implementing a plan for successful technology integration (NCDPI, 2000). The standards are based on national, state, and professional standards for programs, personnel, budgets, resources and facilities to help build a technology rich educational environment.

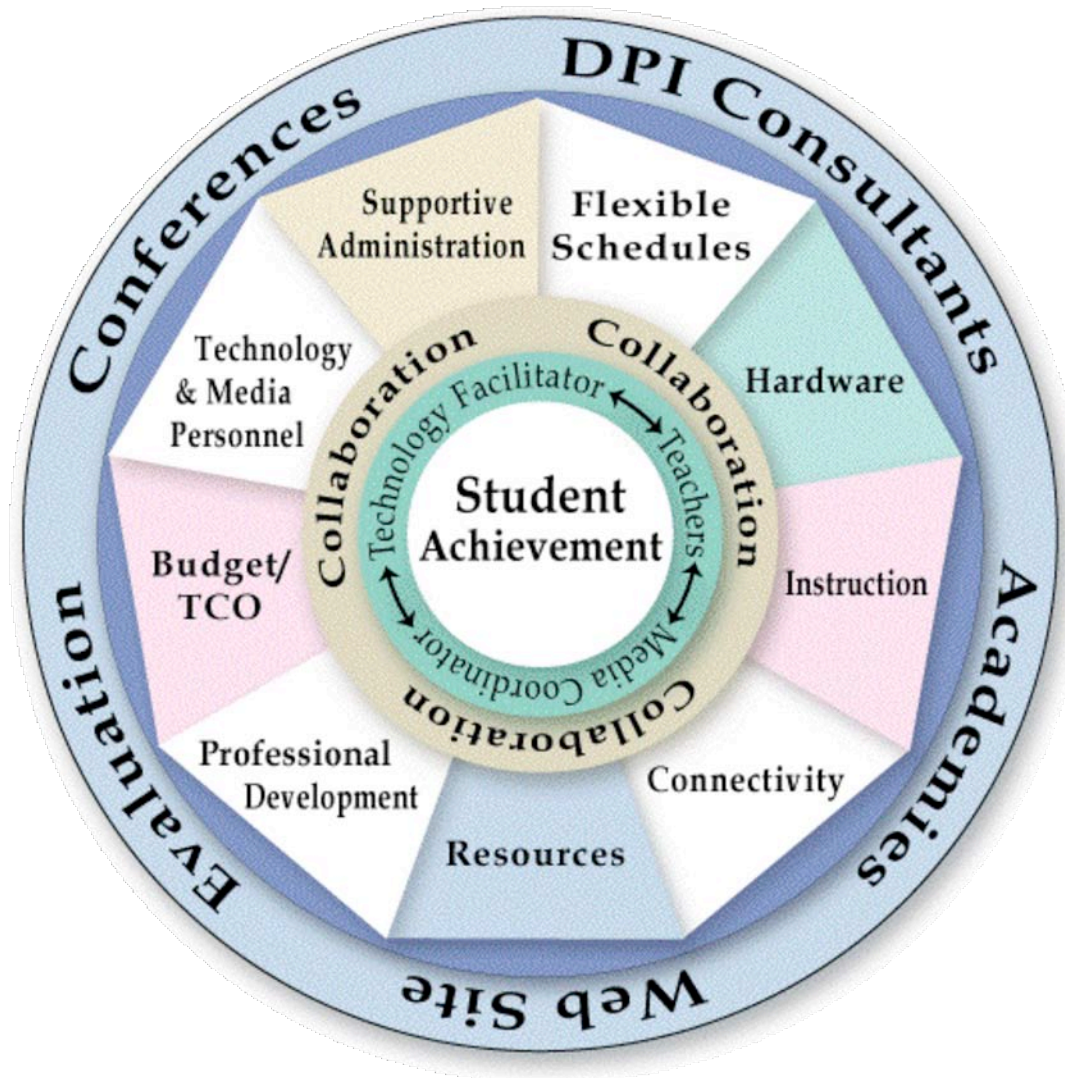


Figure 1. IMPACT model of technology integration courtesy of the North Carolina Department of Public Instruction

The Impact Model addresses four major areas: Teaching and Learning, Information Access and Delivery, Program Administration and System-level Leadership and Support. Each area is evaluated using several indicators. Rubrics have been developed for self-reflection by each school/school system indicating how successfully they are implementing the IMPACT model. Categories for each indicator may be scored

“minimum”, “developing”, or “outstanding.” The rubrics may be found at <http://www.ncwiseowl.org/impact.htm>.

The following are indicators to evaluate for each major category as indicated in Figure 1:

1. Teaching and Learning: Instruction, Staff Development, and Collaboration
2. Information Access and Delivery: Needs Assessment, Managing Resources, and Designing Facilities for Teaching and Learning.
3. Program Administration: Policy and Procedures, Planning, Budget and Resources, Communication and Public Relations, Evaluation, and Personnel
4. System-level Leadership and Support: Standards, Policy, and Procedures, Advocacy, Planning, Budget, Resources, and Personnel

Standards and indicators in the IMPACT model document address needed personnel, i.e., media specialists, instructional technology specialist, technical support. There are also suggestions for the infrastructure (hardware, software, networking, Internet access) and effective staff development plans needed to successfully implement a technology rich environment.

Several guiding principals are emphasized throughout the document and rubrics which include:

- Collaborate with the entire instructional team.
- Lead with vision.
- Utilize media and technology resources.

Collaboration is an important guiding principal within the IMPACT model and refers to a team approach in which teachers, administrators, technology and media specialists

work together to align technology use with the curriculum (NC Standard Course of Study) (NCDPI, 2004) and ensure that teaching and learning is effective for all students. School media specialists are in a unique position to support technology efforts (Faucette, 2000) and may have a positive impact on student test scores by supporting those efforts (Minkel, 2002). The IMPACT model emphasizes the importance of the school media center and the availability of media specialists in the school. Current research also suggests student learning improvement relates to teachers' classroom activities (Ditzhazy & Poolsup, 2002). By encouraging collaboration between teachers, media and technology specialists and administrators, student learning may be improved.

Research Methods

We will use multiple methods of data collection, and when possible, multiple sources of information to triangulate the results.

Online/Internet-based surveys

Currently there are several of these scales already prepared for online data collection. We will utilize and expand these as necessary/desirable to capture self-report data on the variables above. Online surveys have several advantages including elimination of data entry error.

Part of our evaluation plan involves training researchers to make high-quality observations regarding integration and utilization in the classroom, and other behavioral measures such as time-on-task in class. The goal of these observations is to provide triangulation with teacher self-reports of behavioral change. Given what we know about the reliability and validity of self-report data, it is desirable to have multiple methods of data collection to ensure high-quality inference. These data will consist of two types: data

recorded during the observation; and data and events coded and transcribed from video of the observations.

Archival data collection

Where possible, the North Carolina Department of Public Instruction, and the 11 individual schools participating in the program being evaluated will be asked to provide access to archival data on student achievement, teacher retention, and student behavioral measures. To the extent other variables are present in archival data; we will also access those data for triangulation purposes.

Analyses

In general, all of these analyses will be a mixed prospective/retrospective longitudinal design, utilizing archival data from previous years to inform analyses on present and future data and including control groups where appropriate. The specific nature of the variables is too varied to discuss specific analyses, but in general, two strategies will be utilized:

Double-multivariate or single-multivariate repeated measures ANOVA: When the outcome variables are continuous and the predictor variables categorical in nature, and when data is present in all time points, it is often desirable to utilize repeated measures analyses in a mixed between-groups/within-subjects design examining change over time as a function of group membership. These will allow for analysis of change over time as a function of the intervention. Where appropriate, multiple measures at each time point will be incorporated into the analyses making them doubly-multivariate repeated measures.

Hierarchical Linear Modeling: Where predictor variables are continuous, linear modeling is desirable. There are two versions of HLM, one for continuous outcomes and one for discrete outcomes (e.g., retention of teachers and students). In both cases, it is imperative that we utilize multilevel modeling techniques to control for the nested nature of these data, which can cause misestimation of parameters under ordinary least squares (multiple regressions) analyses. In this case we will be performing growth-curve analysis, which will allow for modeling of nonlinear effects and interactions more readily. Furthermore, these analyses utilize more sensitive empirical-bayes or maximum likelihood estimation techniques, which have inherent advantages over more routine multiple regression procedures.

To enhance inference we will attempt to utilize a matched-pair research design where nonparticipating schools that are similar in important characteristics (size, SES, rurality/urbanicity, etc) are compared on key variables above to IMPACT schools to determine if changes observed over time are due to the IMPACT program or other environmental or historical factors.

Results or Expectations

We propose to measure several different types of outcomes as possible effects of the IMPACT grants, including those listed below.

Student Achievement

Because one aim of this intervention is to impact student achievement, we will look at state End-Of-Grade (EOG) test scores available to us via archival data. The exact nature of these tests differ by grade, but in general, we will examine the reading and math scores and, where available, the computer proficiency and the writing scores. The reading

and math tests are given in grades 3 through 8, and the writing test is given in grades 4 and 7. The computer proficiency test is a high-stakes test given in the 8th grade. Students must pass this test in order to graduate from high school in North Carolina.

Attitudes toward computer-related technology

We will examine changes in attitudes toward computer-related technology integration in the classroom for students, teachers, and administrators. The Young Children's Computer Inventory will be used for students in grades 1-3 and the Computer Attitude Questionnaire will be used for students in grades 4-8. The instruments may be viewed from links on the project web site at

<http://ced.ncsu.edu/impact/evaluatorresources.html>,

Integration and utilization of technology in the classroom

We will examine change in the integration and utilization of technology in the classroom and student teacher interaction, both quantitatively and qualitatively. Data in this area will be gathered via student and teacher self-report, as well as observation by trained researchers.

Other behavioral measures

Although there is little to suggest a significant impact on behavioral referrals, truancy, and dropout rates, we will gather these data from archival sources to look for changes. In addition, we will search the literature for other appropriate measures to use in this project.

Leadership style

Knowing that leadership style can influence the success of these sorts of programs, we will use standard leadership style instruments to assess whether a

Principal's, Teacher's, or Media Specialist's leadership style influences the success of the IMPACT model.

Student Results

At this time student post-test data is unavailable for comparison but demographic data and pre-test information will be presented. The following figure shows demographic information for the eleven schools in the study.

SCHOOL	Grades	ADM	% FRL	Indian	Asian	Hispanic	Black	White
ELEM 1	305	469	68.23%	0.00%	0.87%	1.31%	65.94%	31.88%
ELEM 2	306	429	81.59%	0.00%	0.74%	0.99%	75.93%	22.33%
ELEM 3	0K05	589	54.50%	0.00%	2.81%	3.51%	49.56%	44.11%
ELEM 4	0K05	128	55.47%	0.00%	0.00%	0.81%	1.61%	97.58%
ELEM 5	PK02	338	74.85%	0.00%	0.00%	1.22%	34.65%	64.13%
ELEM 6	PK06	339	46.02%	0.00%	0.00%	4.44%	4.14%	91.42%
ELEM 7	PK06	197	49.24%	0.00%	0.00%	2.69%	0.00%	97.31%
ELEM 8	PK05	726	69.01%	0.40%	0.54%	17.79%	45.55%	35.71%
ELEM 9	PK05	665	89.32%	0.33%	0.00%	1.49%	90.10%	8.09%
ELEM 10	PK05	258	53.88%	0.36%	1.82%	2.91%	0.73%	94.18%
MS 1	408	701	59.63%	0.00%	0.00%	0.58%	47.97%	51.45%
MS 2	608	579	74.96%	0.59%	1.47%	7.20%	74.60%	16.15%

Figure 2. Student demographics

Computer Attitudes

In grades 1-3, 2264 students responded to the Young Children's Computer Inventory (YCCI) at the beginning of the intervention. The instrument consists of a 3

point Likert scale. The scale used in the YCCI consists of the following: 1 = No, 2= Don't Know, 3 = Yes.

Only Part 1 specifically dealing with computer use was administered.

Based on the initial administration, it seems that students enjoy using computers, believe that they will help them get a good job and enjoy learning with computers.

The Computer Attitude Questionnaire (CAQ) was administered to 2616 students in grades 4-6 and is similar to the YCCI. CAQ is a Likert instrument for measuring middle school students' attitudes on all Young Children's Computer Inventory subscales plus computer anxiety. The scale used in the CAQ consists of the following: SD = Strongly Disagree (1), D = Disagree (2), A = Agree (3), SA = Strongly Agree (4).

Student responses on the CAQ were quite similar to the YCCI. The additional measures on computer anxiety indicated that the students are generally not anxious about using computers.

These are only preliminary pre-scores which will be compared each year of the study to determine if any change occurs as students use computers more frequently.

Technology Skills Checklist

The Technology Skills Checklist (TSC) was administered to 2070 students in grades 3-5 and 1099 students in grades 6-8. A computer competency test is administered at grade 8 and the TSC will be correlated that test. The TSC is a self-report Likert-type scale for most of the questions designed to indicate what students believe they can do with technology. The scale includes (1) I do not know if I have done this, (2) I have never done this, (3) I can do this with some help, (4) I can do this by myself, (5) I can show someone how to do this.

The TSC will be administered annually to note any changes in perceived technology skills among these students in the study. Preliminary results indicate that students believe they are proficient with basic use of a computer such as using a mouse and shutting it down but need to work more with multimedia such as recording sounds, creating slide shows and using video cameras with a computer.

Other data

At this time achievement data has not been collected for the first year. The end of grade testing (EOGs) will be done in April and we anticipate that the data will be available from NCDPI in late summer. Other measures of student achievement for grades K-2 will also be collected from the schools in the study. Even though these students do take EOGs there are math and reading measures recommended by the state that most are using for assessment.

Implications for Practice

The evaluation of the IMPACT model will help teachers, administrators, teacher educators, and policy makers determine the effectiveness of specific technology integration methods for student subgroups and teachers. The model is designed for ease of replication and may be implemented in other schools if found to improve student achievement or other variables measured.

The evaluation of such a large statewide project will help determine the impact that technology integration has on student learning and teaching and guide practice in the area of instructional technology in the future.

Implementing Federal Mandates

The IMPACT model grant program is funded through the Enhancing Education Through Technology component of NCLB, Title IID. The evaluation of the model is designed to determine its effectiveness in the 11 schools funded throughout North Carolina. NCLB calls for scientifically-based research demonstrating that programs improve student achievement. The NCLB Web site gives a hierarchy of the types of research designated as scientifically based. Randomized trial with true experimental design is considered the most rigorous research design. This type of study can be difficult to implement with real students, teachers, and schools. In the case of IMPACT, funds were awarded to the schools through a competitive grant process and schools were chosen based on their proposals and other criteria, thus making random assignment impossible.

The research ranked second is quasi-experimental design, utilizing comparison groups. This approach was the one chosen for this study. Each of the eleven project schools were matched with a comparison school. The schools were chosen to match on grade structure, geographic region, end-of-grade test scores in the year prior to the project, student demographics, and size. School districts in our state do not all use the same grade structure. We have grade K-2 schools, grade 3-5 schools, grade 4-8 schools and many other types of variations. Matching on geographic region was important: in some of our eastern districts, the economy is based on tobacco, cotton, hogs, or turkeys and the population can have high percentages of African-American or Latino citizens. In other districts, there are more Native Americans or the economy is less agricultural.

Issues and challenges were encountered as we worked with data on all the states' schools to find matches. A large number of low-SES schools were eligible for the grant process for the project. In a few cases, schools selected as comparison schools refused to participate because they did not receive a grant to enter the project. The state education agency, the NC Department of Public Instruction, offered each comparison school a cart with computer and data projector to encourage participation.

Another issue has been the measurement of young children. Of eleven schools in the project, nine are primary or elementary schools. Almost a third of the children are in grades K-2. This study would not be complete without evaluating the effect of the IMPACT model for these students. State law forbids standardized testing for these grades so the evaluation team had to find measures of academic achievement that could be used. There are administration issues with tests for children who cannot read. The testing takes up valuable instructional time for young children.

Thus, the NCLB mandate for scientifically-based research does not translate as a simple and straightforward procedure. There is great variability in schools, students in different grades must be treated differently, and researchers must respect the teachers and their instructional time.

Diversity and Equity

Data will be collected for all reporting categories in NCLB to determine the effectiveness of the IMPACT model for specific reporting categories of students. Specific interventions may be more or less effective with the reporting categories of students. The model will also be evaluated in conjunction with student learning styles, leadership styles, and teacher attitudes toward technology.

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