

# The Impact of School Library Media Centers on Academic Achievement [lance]

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This study provides evidence of the positive impact of library media centers on academic achievement in 221 Colorado public schools during the 1988-89 school year. In contrast to previous research on the relationship, this study uses schools rather than students as units of analysis and rules out the effects of selected school and community conditions that might explain away the relationship. The findings of this study indicate the importance of library media expenditures—and particularly the staff and collections they make possible—in promoting academic achievement. The importance of the library media specialist's instructional role is also verified.

## THE ISSUE

Advocates of school library media centers (LMCs) have long been convinced of the relationship between quality LMCs and academic achievement. The need for evidence of that relationship was demonstrated by the unprecedented publicity surrounding 1987-88 reports of a proprietary study correlating library media expenditures and scores on the National Merit Scholarship Test.<sup>1</sup> The inability of library media advocates to obtain satisfactory documentation of these findings was a major impetus to this study.

## THE LITERATURE

During the past 30 years, fewer than 40 studies have focused on the impact of school library media centers on academic achievement. The majority of those studies occurred between 1959 and 1979. Obviously, the quantitative research in this field is limited. In addition, these studies were limited in scope, often focusing on a small number of subjects in one city or state. For the most part, previous research only supports establishing LMCs and library media specialist positions, not strengthening them. A comprehensive annotated bibliography and time line of this literature are a substantial part of the book<sup>2</sup> (of the same title as this study) on which this article is based.

## METHODOLOGY

This study employed available data on library media centers and their school and community contexts for a self-selected sample. These data were analyzed using three statistical techniques: correlation analysis, factor analysis, and regression analysis.

## SAMPLE

Ideally, schools included in the sample for this study would have been selected on a random, stratified, or quota basis. None of these sampling designs was possible, because two powerful self-selection criteria were at play. Schools included in the sample had to have library media centers that responded to the 1989 survey of school library media centers in Colorado and had to use the Iowa Tests of Basic Skills (ITBS) or Tests of Achievement and Proficiency (TAP). Both participation in the library media center survey and choice of standardized test were determined at the school building level. These data were available for only 221 of 1,331 public elementary and secondary schools in Colorado during the 1988-89 school year.

The need to employ a self-selected sample raised serious questions about the generalizability of the study's findings. Of particular concern were the representation in the sample of different school levels, enrollment ranges, and district settings. In all three cases, comparisons of the distribution of sample schools with the distribution of all schools in Colorado and in the United States, demonstrated negligible variations between the self-selected sample and the state and national universes of public elementary and secondary schools. Table 16.1 presents the sample, Colorado, and United States distributions of schools by level. (For a complete analysis of the representativeness of the self-selected sample, see chapter two of the book.<sup>3</sup>)

**Table 16.1. Sample, Colorado, and U.S. Schools by Level**

**Schools**            .....Sample.....            .....Colorado.....            .....U.S.....

By Level	N	%	N	%	N	%	
Element.	134	61	808	61	51	339	62
Middle	24	11	129	10	7	957	10
Jr. High	15	7	99	7	4	687	6
Sr. High	47	21	247	19	11	350	14
Other	1	0	48	4	7	832	9
Total	221	100	1,331	100	83	165	100

## DATA

This study relied entirely upon available data about school library media centers and their school and community contexts to predict norm-referenced test scores. Because 1990 U.S. Census data were unavailable for this study, data on the following variables were drawn from the 1980 Census: urban and rural percentages of the district population, percentages of district residents in selected racial/ethnic groups, percentages of district residents ages 25 and over who were high school and college graduates, average family size, median family income, and

percentage of district families living below poverty level. Due to the age of these data and their unavailability at the building-level, data on potential substitute variables were drawn from the 1989 building-level files of the Colorado Department of Education (CDE). These included percentages of students in selected racial/ethnic groups and percentage of students in the National School Lunch Program (a potential proxy for median family income and/or percentage of families living below poverty level).

Additional 1989 building-level data were drawn from CDE files to describe important differences among Colorado schools. These fell into two major categories, teacher variables and fiscal variables. The teacher variables were the pupil-teacher ratio, percentage of teachers with master's degrees, average years of experience for teachers, and average salary for teachers. The fiscal variables included total district expenditures per pupil and percentages of expenditures spent on instruction, supplies and materials (a subcategory of instruction), support services, and community services.

Almost half of Colorado's public schools responded to the 1988-89 survey of school library media centers. Those library media centers reported data on the following variables: hours open per typical week; hours per week staffed by state-endorsed library media specialists; total staff hours per typical week; hours per week spent by library media staff identifying materials to support curriculum developed by teachers and collaborating with teachers on curriculum development; holdings by format (book volumes, periodical subscriptions, videos, software packages, and audiovisual materials); numbers of microcomputers and instructional uses of them per typical week; print and nonprint circulation per typical week; materials borrowed or rented from outside sources per typical week; and information skills instruction contacts per typical week.

In this study, academic achievement was represented by scores on selected components of the Iowa Tests of Basic Skills (ITBS) and the Tests of Achievement and Proficiency (TAP). For elementary and middle grades, ITBS scores on reading, writing, and work-study skills were used. For secondary grades, TAP scores on reading, written expression, and using sources of information were used. These test scores were obtained for grades one, two, four, five, seven, and ten. Grades three and six were excluded because large districts included in the sample were reorganizing schools in such a way as to group grades three and six with different other grades. Tenth grade was the only secondary grade for which sufficient numbers of schools reported test scores.

## STATISTICAL TECHNIQUES

Three statistical techniques were used to analyze these data. Correlation analysis was employed to identify redundant variables to be eliminated from consideration. Factor analysis was employed to further reduce and refine the number of potential predictors by combining groups of related variables. Path analysis via multiple regression was employed to measure the direct and indirect effects of each potential predictor while controlling for other variables under consideration.

## FINDINGS

Findings of this study provided bases for eliminating redundant variables, combining related variables, and testing the model (measuring the relative impact of potential predictors on academic achievement).

## ELIMINATING REDUNDANT VARIABLES

Correlation analysis provided bases for eliminating redundant school and community data. None of the available data on library media centers were found to be redundant. (For a detailed report of the results of these correlation analyses, see chapter three of the book.<sup>4</sup>)

Correlation analysis of community variables identified the following problematically strong relationships: 1) rural and urbanized populations within school districts are almost mutually exclusive, and there is little variation among districts between those that are 100 percent rural and those that are 100 percent urbanized; 2) where more adults have graduated from high school, family incomes are higher; 3) where more adults have graduated from high school, more adults have graduated from college; 4) where more adults have graduated from college, family incomes are higher; 5) where family incomes are lower, more families live in poverty; 6) where fewer adults are high school graduates, more families live in poverty. On the basis of these findings, the following variables were discarded: urbanized and rural percentages of population, college graduation, median family income, and percentage of families living below poverty level.

Correlation analysis of school variables identified the following problematically strong relationships: 1) schools with more teachers with master's degrees tend to pay higher salaries, and 2) schools that spend more on instruction in general almost always spend more on supplies and materials, support services, and community services. On the basis of these findings, the following actions were taken: teacher-related variables were referred to factor analysis for potential combination into a single variable, and proportions of total expenditures per pupil spent on instruction, supplies and materials, support services, and community services were discarded as redundant.

Correlation analysis of library media variables identified the following noteworthy relationships: 1) LMCs with larger book collections tend also to have more periodical subscriptions; 2) LMCs that have more to spend on materials tend to have more to spend on equipment; 3) LMCs that have more endorsed staff tend to have staff who spend more time identifying materials for instructional units developed by teachers and more time collaborating with teachers in developing such units; 4) numbers of books, periodical subscriptions, software packages, and videos in LMC collections tend to rise and fall together; 5) use of LMC materials, particularly audiovisual materials, appears likely to increase as teachers begin to involve LMC staff in their instructional planning; and 6) the well-known impact of periodical subscription prices on LMC materials expenditures is evident. On the basis of these findings, the following actions were taken: a collection-size factor based on numbers of books and periodical subscriptions was attempted; separate dollar figures on LMC materials and equipment spending were added together to form one variable; and additional combinations of LMC variables were sought solely to reduce their numbers.

In every grade, students who scored better on reading tests were extremely likely to test better on their use of language and library media centers. For this reason, reading scores alone represent academic achievement in this study.

## COMBINING RELATED VARIABLES

After eliminating redundant variables, the second step in refining the database of potential predictors was to submit related sets of variables to factor analysis. Several factor scores generated by this data reduction technique replaced numbers of related variables. (For a detailed report of the results of these factor analyses, see chapter four of the book.<sup>5</sup>)

Community variables submitted to factor analysis were percentage of minority students, percentage of free-lunch students, percentage of adults graduated from high school, and average family size. The first three variables were combined successfully into an At-Risk Factor. Average family size was dropped from further consideration when it was realized that it was a poor way to operationalize a student's access to parental support, such as homework assistance. (If average family size is three, the typical family might be composed of two parents and one child, in which case the student is likely to be in a relatively advantageous position. Alternatively, the three might be a single parent with two children, in which case the students are likely in a relatively disadvantaged position.)

School variables submitted to factor analysis were total expenditures per pupil, teacher-pupil ratio, percentage of teachers with master's degrees, average years of experience for teachers, and average teacher salary. The three latter variables were combined successfully into a Career Teacher Factor. Both total expenditures per pupil and teacher-pupil ratio were retained as separate variables because of their presumed relationships to academic achievement.

Library media variables submitted to factor analysis were numbers of materials by format (books, periodical subscriptions, videos, software packages, audiovisual materials); numbers of microcomputers; numbers of media-endorsed and total staff hours per typical week; numbers of weekly hours typically spent assisting teachers or collaborating with them in designing instructional units; numbers of service transactions (print and nonprint circulation, information skills instruction contacts, microcomputer uses); and expenditures on materials and equipment. These eighteen variables were reduced to five. Four of these variables are factor scores representing two or more of the original variables.

Anticipated factors representing staffing levels and collection size did not emerge. Instead, total staff hours per typical week and per pupil holdings of books, periodicals, and videos comprise a factor representing the staff and collection size of the library media center. This score was named the LMC Size Factor. Media-endorsed staff hours per week and hours library media staff spend assisting and collaborating with teachers comprise a second factor. This score, which taps the instructional role of the library media specialist, was named the LMS Role Factor. Weekly statistics on print and nonprint circulation and information skills instruction contacts comprise a third factor representing use of library media centers. This score was named the LMC Use Factor. Surprisingly, numbers of microcomputers in or under the jurisdiction of the LMC were unrelated to holdings figures, and weekly instructional uses

of such microcomputers were unrelated to other kinds of LMC use. Instead, these two figures were combined in a single fourth score called the LMC Computing Factor. Predictably, expenditures on library media materials and equipment were strongly related to each other. Because they are both dollar figures, these data were summed into a single fifth score for the remainder of this study. This score is called LMC Expenditures per Pupil.

#### TESTING THE MODEL

Entering the model-testing phase of this study, the original data were reduced and refined to the following 10 variables: the At-Risk Factor, Teacher-Pupil Ratio, the Career Teacher Factor, Total Expenditures per Pupil, the LMC Size Factor, the LMS Role Factor, the LMC Use Factor, the LMC Computing Factor, LMC Expenditures per Pupil, and ITBS/TAP Reading Scores. All nine potential predictors were regressed on reading scores for each of the grades under study (one, two, four, five, seven, and ten).

In the preliminary regression analyses, reading scores for almost every grade were predicted by two variables: the At-Risk Factor and the LMC Size Factor. The preliminary path (beta) coefficients yielded by this analysis are presented in table 16.2. Other variables predicted reading scores for only one or two grades. A second and final analysis was conducted to measure the effects of the two implicated predictors without “statistical static.” The final path (beta) coefficients yielded by this analysis are presented in table 16.3, page 194.

**Table 16.2. Preliminary Path (Beta) Coefficients for At-Risk and LMC Size Factors with Test Scores by Grade**

Grade	At-Risk Factor	LMC Size Factor
1st	-.46	.32
2nd	-.44	.69
4th	-.33	.35
5th	-.38	.45
7th	---	---
10th	-.72	---

**Table 16.3. Final Path (Beta) Coefficients for At-Risk and LMC Size Factors with Test Scores by Grade**

<b>Grade</b>	<b>At-Risk Factor</b>	<b>LMC Size Factor</b>
1st	-.51	.23
2nd	-.45	.39
4th	-.33	.35
5th	-.37	.30
7th	-.40	.47
10th	-.72	.27

It would be premature to make too much of the relative size of the path (beta) coefficients for the At-Risk and LMC Size factors, but the patterns they demonstrate do hold some intuitive appeal. At-risk conditions appear to exert great influence as younger students come into the public schools from the community, less influence during the middle years, and even greater influence as older students prepare to leave public schools. In a complementary fashion, library media programs appear to exert more influence during the middle years of elementary and secondary schooling. These apparent relationships certainly bear further study.

In addition to generating path (beta) coefficients that indicate the relative strength and direction of relationship between different predictors and reading scores, multiple regression analysis also calculated the percentage of variation in test scores explained by the two direct predictors. These results are presented in table 16.4. Consistently, the At-Risk and LMC Size factors explained half or more of the variation in reading scores.

**Table 16.4. Variation Explained by At-Risk and LMC Size Factors**

<b>Grade</b>	<b>Percent of Variation Explained</b>
1st	55
2nd	59
4th	48
5th	47
7th	61
10th	76

After identifying and measuring the impact of the two direct predictors, the indirect effects of other potential predictors were considered. Figure 16.1 illustrates the demonstrated indirect relationships.

- The size of a library media program, as indicated by the size of its staff and collection, is the best school predictor of academic achievement.
- LMC expenditures predict the size of the LMC's staff and collection and, in turn, academic achievement.
- The instructional role of the library media specialist shapes the collection and, in turn, academic achievement.
- LMC expenditures and staffing vary with total school expenditures and staffing.
- The degree of collaboration between library media specialist and classroom teacher is affected by the ratio of teachers to pupils.

**Fig. 16.1. A path model of the impact of school library media centers on academic achievement.**

(figure from original too complex to recreate here)

## CONCLUSIONS

These findings provide evidence needed to answer three major questions about the impact of school library media centers and academic achievement.

1. Is there a relationship between expenditures on LMCs and test performance, particularly when social and economic differences between communities and schools are controlled?
  - Yes. Students at schools with better-funded LMCs tend to achieve higher average reading scores, whether their schools and communities are rich or poor and whether adults in the community are well or poorly educated.
2. Given a relationship between LMC expenditures and test performance, what intervening characteristics of library media programs help to explain this relationship?
  - The size of the LMC's total staff and the size and variety of its collection are important characteristics of library media programs that intervene between LMC expenditures and test performance. Funding is important, but two of its specific purposes are to ensure adequate levels of staffing in relation to the school's enrollment and to ensure a local collection that offers students a large number of materials in a variety of formats.



3. Does the performance of an instructional role by library media specialists help to predict test performance?
  - Yes. Students whose library media specialists played such a role tended to achieve higher average test scores.

## ISSUES FOR FUTURE RESEARCH

Both the sample and the data involved in this study were subject to limitations that future research should seek to overcome.

## SAMPLE

Although the self-selected sample employed in this study fit the profile of public schools in Colorado and the United States by school level, enrollment range, and district setting, it is conceivable that some other important characteristic might distinguish this sample from the universe of public schools it was intended to represent. Numbers of schools involved in this analysis at upper grade levels were sometimes quite small. A larger overall sample would probably eliminate this problem. These concerns will be overcome as the study is replicated in other states. As Colorado schools were not required to use the same norm-referenced test or to provide LMC data, any state that requires either or both of these conditions is an advantageous site for replication.

## DATA

The study is also limited in terms of the data that was used and the data that was not available. By far the greatest data limitation is the use of the ITBS and TAP to operationalize academic achievement. During this study, a revolution in testing has begun. Future research may enjoy the benefit of more authentic assessment data. Subsequent studies also will have the advantage of access to 1990 U.S. Census data on a wide variety of demographic, social, and economic conditions that probably affect academic achievement. Other potential school predictors of academic achievement should be considered in future research. Alternative teaching styles, disciplinary issues, and student turnover are just a few such variables for which data were unavailable to this study. Subsequent studies might also consider other library media variables, such as how access to the LMC is scheduled, how information skills are taught, and how technology is used in the LMC.

## NEXT STEPS

During the past year, the author has made at least 18 presentations on this study at regional, state, and national events. In several states and among at least one group of states, preparations to replicate this study have begun. Recently, in fact, the American Association of School Librarians organized a committee to encourage and monitor such efforts. The principal investigators are preparing to conduct a follow-up survey of those who have received copies of the study report or attended one of the above-mentioned presentations to determine the impact of the "Impact Study." The author urges anyone considering or involved in a replication of the study to notify the Library Research Service and the American Association of School

Librarians. (Contact Keith Curry Lance, Director, Library Research Service, State Library and Adult Education Office, Colorado Department of Education, 201 E. Colfax Ave., Room 309, Denver, CO 80203-1799, voice: 303/866-6737, fax: 303/866-6940, Internet: klance@cde.co.gov. Contact the AASL Replication of the Lance Study Committee via Yvonne Carter, 602 Louis Arceneaux Road, Lafayette, LA 70507, 318/896-6762.)

## NOTES

1. American Library Association, "Pupil Success Firmly Linked to School Library Funding," *American Libraries* 18, no. 8 (September 1987): 632-33; Mary Jo Lynch and Ann Weeks, "School Match Revisited," *American Libraries* 19, no. 6 (June 1988): 459-60.
2. Keith Curry Lance, Lynda Welborn, and Christine Hamilton-Pennell, *The Impact of School Library Media Centers on Academic Achievement* (Castle Rock, CO: Hi Willow Research and Publishing, 1993).
3. Ibid., 10-25.
4. Ibid., 26-44.
5. Ibid., 45-61.