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School Libraries and Science Achievement: A View from Michigan's Middle Schools

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If strong school library media centers (SLMCs) positively impact middle school student reading achievement, as measured on standardized tests, are they also beneficial for middle school science achievement? To answer this question, the researcher built upon the statistical analyses used in previous school library impact studies with qualitative measures in an attempt to discover relationships between science education and school library media programs. Taking into account major external predictors of student achievement, the researcher examined usage, staffing, collection, technology, and budgetary school library media program variables. She found that 2002 eighth-grade Michigan Educational Assessment Program (MEAP) science test scores had a significant positive relationship only with the size of the SLMC video collection. In subsequent qualitative follow-up activity, participants emphasized the importance of providing video in their services to science educators, as well as their challenges in providing high-quality, current science collections. Participants also pointed to teacher collaboration as a primary but underutilized way of improving their link with science teachers. The results of this study imply that while school library media specialists ably furnish science teachers and students with multimedia resources, due to systemic and professional factors, they are not yet consistently and confidently poised to be science collaborators.

Prologue

I would like to begin this formal research report with a personal recollection from my first job as a full-time media specialist. The school, a parochial high school for boys, had always had a librarian on staff, but the administration was thrilled to be able to tell prospective parents that they had a state-certified school library media specialist. After the school year got underway, my days were filled with helping students with their homework, processing new materials, and taking care of the audiovisual equipment. After school, I took the videotaping requests from the science teachers for off-air recordings from public and cable television. Each morning, I retrieved the recorded tapes and apportioned them to our fleet of TV/VCR carts. I pushed the carts down the hall into the science wing and deposited them just inside the doors of the classrooms. Later, I returned to pick up the carts and any request forms for the next day's tapings. I never knew what concepts the teachers taught with the recordings and rarely was asked to provide materials beyond the video cassettes.

I relate this scenario not to illustrate a situation of underuse of a school library media specialist, but to ask you to keep this experience, deeply embedded in my professional memory, in mind as

editorial exclusion; it is more likely symptomatic of a lack of dialogue between school library media specialists and science educators (Mardis 2005).

Science teachers rely heavily upon peers and professional development activities to gain information about new curriculum resources and strategies (Hanson and Carlson 2005; Williams and Coles 2003). When they are enacting instructional activities, they rely mainly on textbooks, Web sites used within their classrooms, and materials from their classroom collections (Hanson and Carlson 2005; Stern and Roseman 2004). Science teachers experience much isolation in their practice (Schlichte, Yssel, and Merbler 2005; Tobin and Roth 2005; Weld 1998), with many of them teaching out-of-field, and, perhaps as a consequence, are plagued by persistent rates of attrition and shortage (National Science Foundation [NSF] 2006). Another complicating aspect of the science teaching and its suitability for school library collaboration is the prevalence of new teachers (NSF 2006). New and early career science teachers often are still developing their sense of instructional (Settlage 2004) and content-area (Dennick and Joyes 1994) mastery, as well as establishing control in the classroom (Hensley 2002); they are less likely to reach out and form collaborative and collegial relationships outside their departments until they gain confidence in all aspects of their practice.

The Suitability of School Libraries for Science Learning

Many middle school students feel that learning science with the aid of a variety of resources, such as those found in the school library, is very important. Multimodal learning (that is, learning through a variety of textual, electronic, digital, and physical media) helps to build essential prior knowledge, the platform upon which subsequent learning takes place (Bransford, Brown, and Cocking 2000; Hirsch 2006; Roschelle 1995). Moreover, the increasing prevalence of English language learners in all schools presents a challenge to classroom-based science instruction (Lee 2005). When students who lack English language proficiency are encouraged to learn science in a hands
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media programs and science achievement in eighth-grade students from Michigan. This paper reports the results of the mixed-method sequential explanatory study undertaken to uncover the connection between school library media programs and science achievement, as well as the factors present in the relationships between school library media specialists and science teachers that encourage student achievement on state-mandated standardized tests.

Statement of the Problem

If strong SLMCs positively impact middle school student reading achievement, do they also have positive relationships with middle school science achievement? The 2002 MSLS showed that school library media specialists' support, qualifications, and facilities played essential roles in promoting student reading achievement (Rodney, Lance, and Hamilton-Pennell 2003); many of the questions that led to these conclusions may be asked about the effect of school library media programs on science achievement. Research questions addressed in this study included:

- How is the relationship between school library media programs and reading achievement similar to the relationship between school library media programs and science achievement?
- What are the characteristics of school library media specialists and school library programs that influence the relationship to science achievement?
- In what ways do school library media specialists think that yearly testing in science and other systemic pressures will affect their relationship with science educators and students?
- What factors do school library media specialists identify as key to effective interactions with science teachers and students?

Methods

To address the research questions, the researcher designed a study that built upon the statistical analyses used in the MSLS with qualitative measures in an attempt to discover perceived relationships between science education and school library media programs. The research felt that the data should represent normal distribution and a truly random sample, as based on

Table 1. Summary of Community, District, and Building Variables for Schools in the Study Sample

Variable	N	M	SD
Community			
Average salary	192	$49,710	6708.00
High school graduation rate	194	84%	7.07
District			
Percent of students eligible for NSL	188	30%	.23
DPPE	196	$3536	585.00
Building			

Summary of Results

The results of the two data-gathering approaches are presented in two separate sections, quantitative results and qualitative results.

Quantitative Results

Two statistical approaches were used to analyze quantitative data: bivariate correlation and multiple linear regression. The results of these analyses are presented below.

Bivariate Correlations

In this study, reading and science MEAP scores were individually paired with the 117 numeric variables gathered with the MSLS surveys. Results of the Pearson's product-moment (PPM) correlation tests are given in tabular format. Due to the large number of variables examined, the PPM test results are condensed and summarized into two tables: a table that shows significant positive correlations, and a table that shows negative correlations. Interpretations and analyses of the tables are provided. Each table reports five items:

1. The first column of each correlation table identifies which SLMC variable is being paired with seventh-grade reading MEAP test scores and eighth-grade science MEAP scores.
2. The second column of the table reports n1, or the number of survey responses from school library media specialists who serve seventh graders.
3. The third column of the table reports r1, the correlation coefficient relative to the seventh grade reading scores.
4. The fourth column of the table reports n2, or the number of survey responses from school library media specialists who serve eighth graders.
5. The fifth column of the table reports r2, or the correlation coefficient relative to eighth grade science MEAP test scores.

Positive Correlations

SLMC variables have some notable pos ( )Tj EMomelhows a0()-2(i)-2-2.34 Td [(5)-18(ei)-[2(a)ve-3045

	Access to library databases on computers in school	162	.268	156	.275
	Video materials (cassettes and disks)	190	.144	182	.256
	Total library computers	198	.252	190	.242

Total visits to the library by

hours seem to have no relationship to student achievement in science, but a negative relationship to reading test scores.

Multiple Regressions

The significant, positively correlating variables in table 3 were grouped into clusters: service hours; paid staff; paid staff hours; staff activities (in hours); school library media specialist usage, computers in SLMC; computers (elsewhere) in school; collection; and expenditures; these clusters are depicted in figure 1.

Figure 1. Clusters and Variables Used in Multiple Regression Analyses

Cluster	Variable
Service hours	Hours available for flexible scheduling
Paid staff	Credentialed SLMS
	Total staff
Paid staff hours	Credentialed SLMS hours
	Total staff hours
Staff activities (in hours)	Teaching students cooperatively
	Providing in-service training
	All other library activities plus extra duties
	Identifying materials for teachers
School library media center usage	Total visits by classes or groups
	Total visits by individuals
Computers in school library media center	Total computers
	Access to MeL databases
	Access to the Internet
	Access to SLMC databases
	Student access to SLMC catalog
Computers in school	Access to SLMC databases
	Access to MeL databases
	Student access to SLMC catalog
	Access to the Internet
	Total computers
Collection	Video materials

	Books of all types
	Encyclopedias and reference titles on disk
Expenditures	Total expenditures

The "videos per one hundred students" variable alone accounted for 2 percent of the remaining approximately 60 percent of science achievement; while the correlation is not strong, this percentage denotes a significant correlation to science achievement when the major external predictors are taken into account.

Qualitative Results

The e-mail discussion group participants were asked to respond to a number of questions that related to the quantitative findings and to their approaches to dealing with science resources, education, teachers, and students.

Collection Development in Science

In the first discussion question, respondents were asked "How do you approach science collection development in your school media program?" All of the respondents provided answers to this question. Dominant themes in participant responses included the age of science collections, the involvement of science teachers in the collection development process, and the -14(c t)-22(pr)3(oc)46 Tc -07othe

Influence of Professional Preparation

In the third discussion question, the participants were asked to comment on how well their prior experiences, education, and current activities prepared them to work with science teachers: "What type of professional preparation do you feel best positions you to work with science teachers and students?" A group of themes emerged from this discussion: undergraduate experiences, graduate school media coursework, professional development, and other types of learning activities.

Only a few respondents had undergraduate educations that focused on science. As one school library media specialist wrote, "In my case, my college experiences have put [illegible]

In an effort to compensate for their lack of experience with science topics, school library media specialist s in the discussion group undertook a variety of alternatives to school-provided professional development. Some respondents sought coursework outside of school. As one school library media specialist wrote, "I've availed myself of opportunities to take Bureau of tt

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specialists were unsure of how to address this situation because their professional training and various systemic factors made collaboration and communication with science teachers difficult.

Figure 2. Summary of Discussion Questions and Themes in Qualitative Data

Question	Themes
1. How do you approach science collection development in your school media program?	• Science collections tend to be old. • Science teachers are erratically involved in the collection development process. • The selection of science materials is challenging. • Video is an important part of science collection development.
2. How is video used with science in your school media program?	• Student learning styles amendable to video. • Competition with classroom collections leads to underuse or hoarding. • School library media centers must have enough equipment.
3. What type of professional preparation do feel best positions you to work with science teachers and students?	• Undergraduate experiences influence service areas. • Graduate coursework did not prepare SLMS for science. • Professional development opportunities scarce. • Other learning activities have to be sought.
4. How do you feel that the resources in the science classroom affect your ability to be involved with science?	

1998): learning and teaching (instructional) role, information access and delivery role, and program administrator role. Within each of these roles, school library media specialists performed activities relating to collaboration, technology, and leadership.

Question 1. How is the relationship between school library media programs and reading achievement similar to the relationship between school library media programs and science achievement?

The overriding research question of this study was to determine if school library media programs have similar relationships to science achievement as to reading achievement. The results of this study suggest that the relationship between schoolelationship betweb606etdp(m)2.10(s010(lha)4(>)-14(

Building-Level Leadership Sets the Collaborative Tone

Although the individual correlations in the quantitative analyses indicated that the number of credentialed and other library stavtheado0 TwE4(t)-2(i.15 TD [(0.32 re W 4d [(cr)-1(nd ot(ad)13(o3(of)

The second implication of the study is that school library media specialists felt that curriculum demands and other systemic pressures affected their relationship with science educators and students. School library media specialists who participated in the discussion group described situations in their schools where science teachers concentrated their teaching efforts on textbooks and laboratory activities. The focus on covering the science curriculum left little1-2(u.9i)-scn /H(a)4(-10

Conversations about domain strengths, resource collections, and learning strategies tend to be enabled by the type of information credentialed school library media specialists gain in their preservice education. Leadership is very important in expressing the professional confidence and depth of program knowledge to persuade classroom-bound science educators that SLMC activities connect with their curriculum and that collaboration will result in better student experiences and improved interaction with science content.

Information Access and Delivery Is a Starting Point

The results of this study suggest that the roles described in Information Power (AASL and AECT 1998) still accurately describe contemporary school library media specialists' activities and responsibilities. Current research cited in the introduction to this paper and the responses of school library media specialists who participated in the discussion group describe job responsibilities in terms of the learning and teaching role, the information access and d0 Tw(a)61r

Correlation Puts Causation in Reach

Correlational studies do not offer readers causal relationships; researchers' interpretations of the results of these studies are often subjective and not absolute. And, when these analyses are applied to survey results do not reflect a random sample and that may reflect respondents' personal motivation or time to complete the survey, peculiarities of the instrument, or any number of other factors that can influence the survey return, greater caution must be used in drawing definitive conclusions or mandates.

The Colorado-style studies report significant, positive correlations to advocate for the support for schoolesp6;nt th,sh,sra that comstiment to advoc43(a)4(c)-16(y)20(undo)-10herscre tve im h,snalye frtr Correationnsul be the r-5(ings)]TJ 0 Tc 0 Tw 0.54 0 Td ( )Tj [po(i)-2(nt)-2,o not the f(c) ten dorrelatio na(aus)-9(at)-6(i)-6(o di)-14esesh,usilyundherst for(s)-1(c)4(hlt)-2(a)4(r)3(s)-1, bunt at a u o(s)-1(e)4(w)2(dom)-2(w)2(e)4(s)-1(t)-2(u)-10(y)20( )-10aen wd(s)-1(e)4(be)4(ha)4vilor e s to atrare old(n(c)4(a)4((s)-1(e)4(a)4(d o)-10he)4 f)3frect reationsih,shatits the(pr)3obple

Fifteen years and two versions of Information Power later, it would appear that school library media specialists are still literally and figuratively managing the AV carts. Now, school libraries may contain DVDs and streaming video servers instead of VHS cassettes, but the end result is the same. That is, the school library's most influential function for science learning, of the aspects studied, is the provision of materials science teachers do not already have in their classroom collections. Deep collaborations with science teachers that make use of the expertise and resources of the SLMC are not consistently occurring, and their infrequency may the squeaky wheel (of the AV cart) that needs our intellectual and professional grease.

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