Collection and Collaboration: Science in Michigan Middle School Media Centers

Marcia Mardis is Assistant Professor in the Library and Information Science Program at Wayne State University in Detroit.

Ellen Hoffman is Associate Professor of Educational Technology at the University of Hawaii at Manoa in Honolulu.

Introduction

In many ways, science classrooms and school library media centers are parallel universes struggling with their own reform issues and with documenting their own positive impacts. As the trend toward data-driven decisions grows in the school setting, it is increasingly important for every component of the learning environment to have demonstrable effect and to be mutually reinforcing. Yet, science reformers do not seem to recognize the potential for school library media specialists (SLMSs) to support their efforts (Lanahan, 2002) , nor do school library media practitioners and researchers seem to be building relationships with science educators (Abilock, 2003).

In The Impact of Michigan School Librarians on Academic Achievement: Kids Who Have Libraries Succeed (Rodney, Lance, and Hamilton-Pennell, 2003), the Michigan School Library Study (MSLS), researchers investigated variables from the Colorado study (Lance, 1993). They also looked at additional characteristics of school librarians and school library programs that affect academic achievement, the contribution of collaboration between teachers and school librarians to the effectiveness of school library programs, and the effects of media center and school building computers with access to educational resource databases and the Internet.

The researchers concluded that Michigan Educational Assessment Program (MEAP) test reading scores for seventh graders tended to improve with access to many specific features of middle school library programs. In particular, through their survey responses, middle school SLMSs communicated that they used a broad range of print and nonprint resources to support the curriculum. In addition, SLMSs often provided collaborative instruction, professional development, and direct student assistance. Even when school and community conditions were taken into account, the researchers found that strong middle school library programs had a statistically significant relationship student MEAP reading test performance (Rodney, Lance, and Hamilton-Pennell, 2003).

In response to MSLS, Mardis (2005) addressed the question, "If strong school library media programs positively relate to middle school student MEAP reading achievement, are they also positively related to middle school MEAP science achievement?" To answer this question, the researcher used the same statistical analyses in MSLS and the input of a follow-up focus group in an attempt to discover relationships between science education and school library media programs. The findings of the study indicated that when major predictive factors of student achievement, such as district minority enrollment, socioeconomic status, and per-pupil expenditure, were taken into account, only the variable reflecting the number of videos per one hundred students had a significant correlation with middle school student achievement in science.

In 2004, just prior to the Mardis (2005) study, the researchers of the present study sought to determine the degree to which Michigan school library media specialists who worked with seventh and eighth graders were able to support science education in their schools. The researchers used a survey that asked questions aimed at uncovering the collection and collaborative support of a school library media center (SLMC) program that could potentially have acted as barriers to working with science teachers and students or that could be used as leverage points to expand the coordination between school library resources and science learning. The results of the survey data suggest that nonbook resources and frequent collaboration are the aspects of the school library media program that have the most compelling relationship with middle school student achievement in science.

Review of Literature

The researchers devised questions for the survey based on themes drawn from school library media research and professional literature. Based on the researchers' analysis, the major themes addressed in the survey were collections and collaboration activities.

Collections

Young (2001) addressed the issue of school library media center collection development in science and acknowledged that many school library media specialists struggled with collection development because they lacked formal education in this area. Young points out that science information changes very quickly, and information in recently published books is often outdated before the books are placed on the media center shelves. Young emphasizes that staying abreast of developments in scientific fields to maintain a current science collection is probably the most challenging collection development task a school library media specialist faces. To ensure collections contain high quality and relevant materials, Young suggested that SLMSs look to the school's science textbooks for resource suggestions and include science teachers in collection development activities.

In a later article, Young (2003) discussed the need for SLMSs to recognize the overlap between many of the values of information literacy and the National Science Education Standards (National Research Council [NRC], 1996) a topic explored in great depth by Mardis (2006). Young posited that an examination of both sets of ideas is a clear mandate for SLMSs to promote information and media literacy in science by working closely with teachers to plan lessons and with students to teach them information skills.

Young's recommendations are in line with the fact that 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. Kirschenbaum (2006) found that contemporary readers learn better through highly visual presentation and other researchers have suggested that multimodal learning helps to build essential prior knowledge, the platform upon which subsequent learning takes place (Bransford, Brown, and Cocking, 2000; Hirsch, 2006; Roschelle, 1995).

Collections in Michigan

Participants in the Mardis (2005) study focus group likewise suggested that video delivered via a variety of media was a very important aspect of their service to science educators. The participants also suggested that, due to the expense of science books and their lack of familiarity with science topics, collecting and maintaining science collections was difficult.

Prior research specifically on the content of Michigan school library media center collections is almost entirely absent other than that the MSLS reported that at all grade levels, the size of the media center print collection had a significant correlation to student reading achievement. Internet databases had a similar significant correlation with student reading achievement, but video resources did not. Mardis (2005) found that in one Michigan district, middle school science teachers felt that the SLMC lacked current or numerous enough science resources to support their teaching. Instead, the teachers discussed their use of classroom collections and computers to supply students with information supplemental to the textbook.

Collaboration and Performance of Professional Roles

Research indicates that SLMSs are most often involved in the less complex levels of instructional collaboration. Slygh (2000) reported that teachers in the select national Library Power schools indicated a greater frequency of collaborating with the SLMSs for planning and designing instruction than for delivering it. Michie and Chaney (2000) found that the overall percentage of library media center personnel working with teachers on curriculum development, collaboratively teaching curriculum units with classroom teachers, or collaboratively evaluating curriculum units with classroom teachers, ranged from 2 percent to 21 percent, depending on the subjects taught. The greatest amount of collaboration was with reading or English teachers; only 9 percent of science teachers nationwide reported collaborating with SLMSs on choosing materials or delivering instruction.

Barriers to SLMSs practicing the instructional consultant role include their own attitudes as well as those of teachers, and principals. In addition, such program limitations as scarce resources and lack of technology prevented full exercise of the instructional role. Lai (1995) found no significant differences between teachers' and media specialists' attitudes regarding SLMSs' roles in curriculum development, instructional development, and technology use. Both groups believed that the media specialist had only a marginal role in designing and producing materials for instructional use. In a national survey by McCracken (2000), the biggest barriers cited to collaboration were little time and few financial or clerical resources.

Research has indicated that a collaborative school environment fosters more coordination with media specialists. As SLMSs become aware of teachers' needs, they are able to provide for regular students as well as those with special needs. In a case study of a suburban junior high school, Straessle (2000) concluded that the more teachers and administrators understand and experience the SLMS as an instructional partner, the more likely their perceptions will change and their expectations will increase, thus improving teacher instruction and student learning. Slygh (2000) reported that SLMSs' perceptions of the degree to which their school climate was a professional community was linked to the amount of instructional collaboration they performed.

Collaboration and Professional Roles in Michigan

In a recent presentation of Michigan-focused survey research of Information Power (1998) roles, Drake (2005) reported that of the 104 SLMS and paraprofessional staff acting in SLMS roles who responded, only 6 percent reported successful implementation of teaching role and only 14 percent reported successful performance of the instructional consultant role. The survey participants cited lack of funds, lack of professional school library staff, lack of teacher understanding, and scarce professional development as barriers to improving their abilities to execute teacher and instructional consultant roles.

Likewise, participants in the Mardis (2005) study focus group pointed to a lack of professional development opportunities in science as a barrier to their pursuits of closer work with science teachers and students. Not only were the participants often not permitted to attend professional development events because they were not considered teachers, but they also were not welcomed on curriculum committees or permitted to engage in tasks that might leave the library unstaffed. Some study participants mentioned that these barriers were not just specific to their attempts to work with science teachers, but were symptomatic of their challenges to collaborations with teachers in all areas.

Statement of Problem

The literature discussed in this paper suggested that values inherent in science education and in school library media programs have enough overlap to warrant investigation. Keeping up-to-date and appropriate science collections is particularly challenging for SLMSs, yet the ability for SLMCs to provide a variety of learning resources was welcomed by students. Teachers considered the SLMC's science collection as inadequate for their needs and, perhaps as a result or concurrently, few Michigan SLMSs performed instructional partnering roles.

Therefore, the researchers designed a survey to probe these issues more deeply. The research questions that framed this survey study were:

1. What is the age and extent of science collections in Michigan middle school library media centers?
2. How do SLMSs perceive their collaborative and Information Power (1998) roles in relation to science?
3. How do the variables recorded in the survey results relate to science achievement?

Methods

Researchers from the Library Research Service (LRS) organization, who conducted the 2002 MSLS, furnished the researchers with a database of MSLS participants. For the survey discussed in this article, in summer 2004, the researchers distributed the surveys to persons in school libraries in public school buildings that served seventh- and eighth-grade students who also completed surveys for MSLS. This selection of schools was an attempt to examine data from schools in which the same library staff supported both the students who took the seventh-grade MEAP reading test and the eighth-grade MEAP science test.

The final sample included in this study was drawn from the 196 public school buildings that served seventh- and eighth-graders in Michigan, as described from the LRS database. Of the 196 surveys mailed, 73 (37 percent) of the surveys were completed and returned. Further detail about the sample schools' library media programs was gleaned from the information recorded in the MSLS data set.

Description of Sample

Respondents represented schools from districts all over the state, with fifteen counties represented. Eighty-five percent of the parents in the respondents' communities had graduated from high school The districts in which these professionals worked had an average per-pupil expenditure of $3,611, an average teacher salary of $50,226, and an average of 22 percent of students who met the requirements for the federal free or reduced-price lunch program, and about 12 percent of students who represented a minority group. Each of the respondents' school buildings included an average of 640 students with a teacher-pupil ratio of 1:5.

According to MSLS data, the respondents' libraries had an average of two staff members total, including the SLMS. In the media centers for which they completed the survey, their collections contained, per 100 students, 19 print volumes, 38 videos, and 6 periodical subscriptions. The respondents' budgets in 2002 averaged $9,458, with an average per-child expenditure of $15.48. Table 1 summarizes the characteristics of the sample respondents' communities, districts, buildings, and SLMCs.

The survey respondents represented professionals in early to mid-career with fifteen years or fewer as a media specialist (n=40) and seasoned professionals with more than fifteen years in their roles (n=31) in buildings described as middle schools (n=57). Most of the professionals (n=64) had a master's degree in library science and held teacher certification (n=66). Most of the respondents had earned their degrees and credentials since 1995 (n=34) and participated in school library media-focused professional development since 2001 (n=66). The respondents were predominantly white (n=71), women (n=68), and 50 years or older (n=45), that is, born in 1954 or before.

According to data reflected in MSLS, the respondents characterized their daily activities as split between working with teachers on planning and teaching lessons, teaching information skills, attending building-level faculty and administrator meetings, performing collection tasks, and managing technology. No single set of responsibilities dominated their days, though the tasks relating to the management of technology and working with students to teach information skills occupied slightly more time, as reflected in figure 1.

In sum, the picture of the study participants' school library media programs that emerged was that they were in moderately prosperous, predominantly white communities that included parents with at least minimal education. The districts were resourced adequately enough to have favorable teacher-student ratios, attractive salaries, and enough students enrolled to warrant separate middle school buildings. The SLMCs were mostly staffed by experienced, fully credentialed professionals and paraprofessionals. They were busy environments filled with students from classes using a variety of media and technology. The SLMS spent her time on a variety of tasks and did not focus predominantly on teaching or instructional partnering.

Description of Instrument

The survey instrument was divided into four sections. The first section included questions about the media center collection, especially the size and age of the Dewey 500 and Dewey 600 circulating, reference, and periodical collections as well as Web-based, CD-ROM, and video resources. The survey questions in the second section focused on collaboration with science teachers, mathematics teachers, and the media specialists' roles in science and mathematics competitions. Section three of the survey included questions about media specialists' personal characteristics, professional preparation, professional reading, and Information Power (1998) roles performed. Finally, section four had questions in which respondents expressed their interest in participating in follow-up interviews and activities.

Results

This section reports the analysis of the data collected from the collections and collaboration questions from the first two sections of the survey.

Collections

This questions in this area asked respondents to provide information about their circulating, reference, periodical, and non-print media collections in the area of science, mathematics and technology.

The School Library Media Center Collection

Books

This question of the survey required respondents to list the number of circulating and reference volumes as well as note the volumes' average age in their natural sciences and mathematics (Dewey call number 500-599) sections and computers, technology, and applied science (Dewey call number 004-005 and 600-699) sections. Table 2 contains the characteristics of the survey respondents' science, mathematics, and technology collections. The table also reports the range of collection sizes and average and range of publication dates reported by the survey respondents.

The response data for this survey question suggested that each of the subsections of the subject areas was represented, with an average of 721 circulating volumes and 115 reference volumes in the 500 Dewey call number range. Chemistry collections tended to have the fewest number of circulating volumes while physics and mathematics collections had the fewest reference volumes. The average publication date of the volumes in the 500s section was 1988, with some volumes published as long ago as 1974. The newest volumes were published in 1999.

In the 600 Dewey call number range, collections contained an average of 556 circulating volumes and 39 reference volumes. The fewest circulating volumes tended to be in the manufacturing section, while many of the reference sections such as management, chemical engineering, manufacturing, and building contained less than one volume, on average. Like the 500s, the average publication date was in 1988, with the oldest volumes only slightly newer, in 1976. These collections tended to be newer, with the newest volumes published in 2004.

Nonbook media

The second survey question asked respondents to state the number of web-based journals and magazine databases, web-based reference resources to which they subscribed, the number of networked and stand-alone reference titles as well as the number of video media and periodicals in the 500s and 600s in their collections. The survey responses are depicted in table 3.

As table 3 shows, the survey respondents subscribed to an average of six periodical titles that addressed science, mathematics, and technology topics. Those print periodicals were supplemented with an average of four Web-based periodical databases and four Web-based reference databases. On average, the respondents used almost no networked CD-ROMs and about eight stand-alone CD-ROM resources in this topic area. Web-based and

CD-ROM resources were fairly new additions to their collections with less that five years of subscription for each item.

Video, either in cassette or DVD form, played a more substantial role in respondents' science collections with an average of 153 titles in each collection. Only one respodent reported streaming video, such as that provided by UnitedStreaming, as part of the SLMC collection.

Collaboration and Professional Roles

SLMSs who returned the survey also responded to a questions about their collaboration with science teachers and a question about the professional roles they felt they performed the most in relation to science.

As table 4 shows, about half, 53 percent (n=39) of the respondents reported that they rarely collaborated with science teachers. Despite the fact that 18 percent (n=13) of the respondents never worked with science teachers, an encouraging 29 percent (n=21) of SLMSs who participated in the survey partnered with science teachers at least a few times per month.

Mathematics teachers were far less frequently part of collaborative activities. More than half, 55 percent (n=40), of the SLMS respondents never collaborated with mathematics teachers, while the bulk of the remaining respondents (n=31) collaborated with mathematics teachers once a month or less.

In relation to science, the two professional roles that participating SLMSs identified as important were the information specialist role (n=52), in which they ensure that students and teachers have access to appropriate high-quality materials for the learning needs, and the teacher role (n=41), in which they impart information and other library-specific skills to students in lessons that are not collaboratively taught with classroom teachers. The respondents' feeling about other roles and the degree to which they feel that all of the roles are important is reported in table 5.

The final step of the analysis was to compare the variables recorded to the science achievement of middle school students in the participating schools. The results of the comparison, a bivariate correlational analysis, are reported in table 6. For purposes of brevity and relevance to the research question, the table contents were limited to variables that showed significant correlations with student scores on the science portion of MEAP. Because previous studies of the relationship between SLMC collections and SLMS collaborations and science achievement have not been done, two-tailed analyses were used, allowing for positive or negative relationships to emerge.

As shown in table 6, most of the variables with significant relationships to science achievement were ones that included the number of periodical subscriptions, with mathematics and general science periodicals showing the strongest and most significant relationships with science achievement. Other variables that demonstrated significance with MEAP science achievement were computer science, technology, and applied science reference, with life science references demonstrating a particularly strong and significant relationship. Finally, the degree to which SLMSs collaborated with science teachers also demonstrated a significant relationship with MEAP science achievement.

Conclusions

The results of the survey analysis have a many implications in terms of the study questions and the relationship between school libraries and science education. The analysis will be presented in terms of the research questions.

What is the age and extent of science, mathematics, and technology collections in Michigan middle school library media centers? The results suggest that science collections in respondents' science, mathematics, and technology collections are unsubstantial, but aging. Books as old as thirty years are on many of the collections' shelves, though some collections do contain newer books. Young (2001) warned SLMSs that collection development in science is challenging and that the currency of the collection must be a major consideration. Mardis (2005) also forewarned that SLMSs were not secure with their skills in book-related collection development and often tolerated inherited and old science collections. Perhaps as compensation, the survey respondents included a variety of periodicals, databases, CD-ROMs, and videos in their collections. While the findings did confirm the perception that science book collections are weak areas in school libraries, the presence of other types of media may supplement any deficiencies in the collections with current and dynamic materials.

How to SLMSs perceive their collaborative and Information Power (1998) roles in relation to science? Collaboration with science teachers was occurring on at least a minimal level in the professional tasks of the respondent SLMSs, though they seemed to have a much more challenging time forging partnerships with mathematics teachers. When the SLMSs professional roles are taken into account, the interactions with science teachers most likely took place through information resource provision and the teaching of science students' information skills they need to complete their science assignments. SLMSs primarily acting as the information specialist and the teacher of information skills is also in line with previous research by Slygh, Straessle, and Drake. The performance of these roles is especially encouraging when one considers that SLMSs are focusing on current and dynamic sources of science information, and as information specialists, may well be promoting those resources to science teachers and students.

How do the variables recorded in the survey results relate to science achievement? The final step of the analysis correlated all the survey variables with results of the 2002 eighth grade science MEAP test. The significant variables mostly related to print and Web-based periodicals in various areas of science and mathematics. But the number of computer science, technology, applied sciences, and life sciences reference books also demonstrated significant correlations to science achievement. Books are usually placed in the reference section if they are not appropriate for circulation due to content, cost, or size. The size and cost of a book is often dictated by the number of color illustrations it contains; the prevalence of images may be the common link between the importance of periodicals and the importance of reference books to science achievement. As Kirschenbaum (2006) pointed out, students comprehend more of what is presented to them in color and they prefer "visually stunning, multi-sensory ways of reading" (50).

It should also be noted that a final aspect of the significant variables was that collaboration with science teachers also demonstrated a relationship to science achievement. That is, in schools where SLMSs collaborate with science teachers frequently, student achievement in science tends to be higher.

The results of the survey, when contextualized with prior research on SLMC collections and SLMS collaboration, suggest that the key to successful support of science education in Michigan middle schools is for professionals to continue to work toward collaborations with science teachers by focusing their energies of building collections replete with a variety of image-rich, current media.

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Table 1. Community, district, building, and SLMC characteristics of survey respondents

Measure	Number responding (N)	Average (M) or Number (n)
Community Characteristics		
Counties represented	72	15
Parents with high school diploma (average percent)	61	85
District Characteristics		
Per-pupil expenditure (average)	61	$3,611
Teacher salary (average)	64	$50,226
Students qualifying for free or reduced-lunch (average percent)	59	22
Average minority enrollment (average percent)	64	12

Building Characteristics		
Buildings identified as middle schools	73	57
Buildings identified as junior high schools	73	4
Buildings identified as high school	73	12
Enrollment (average)	64	640
Pupils per teacher (average)	62	5
SLMC Characteristics		
Annual expenditures (average)	61	$9,458
Library expenditures per student (average)	61	$15.48
Staff (average)	64	2
Print volumes (average)	60	10,970
Video (average)	57	250
Periodicals (average)	60	17
Audio titles (average)	59	63
Software titles	58	7

(average)		
Computers	64	33
Class visits per week	61	22
Items circulated per week	64	438

Table 2. Science, mathematics, and technology collection characteristics of respondents' SLMCs.

Dewey Number Range	Subject	Number Responding (N)	Circulating Volumes (M)	Circulating Volumes (Min/Max)	Reference Volumes (M)	Reference Volumes (Min/Max)	Publication Date of Volumes (M)	Publication Date (Oldest/Newest)
Natural Science and Mathematics								
500	General science	64	71	20/900	42	0/200	1988	1974/1999
510	Math	63	21	3/165	2	0/15	1987	1966/1999
520	Astronomy	63	65	6/141	4	0/21	1990	1978/2001
530	Physics	63	38	1/101	2	0/15	1988	1972/1999
540	Chemistry	63	24	1/82	8	0/105	1988	1965/1999
550	Earth sciences	63	88	10/250	9	0/40	1988	1974/2001
560	Paleontology	62	24	0/75	3	0/20	1988	1974/1999
570	Life sciences	63	91	3/350	15	0/95	1988	1971/2001
580	Plants	63	49	7/200	5	0/40	1984	1969/2001
590	Animals	63	260	51/578	39	0/100	1987	1972/2002
All 500s		64	721	20/2175	115	12/455	1988	1974/1999
Computers, Technology, & Applied Sciences								
004-005	Computer science	59	19	0/267	2	0/21	1994	1975/2004
600	General technology	62	21	1/79	9	0/51	1990	1974/2002
610	Medicine	64	151	0/947	20	0/102	1990	1976/2002
620	Engineering	64	136	0/377	5	0/31	1988	1977/2004
630	Agricultu	63	97	0/379	3	0/25	1987	1974/2004

	re							
640	Home economics	64	86	0/533	3	0/40	1988	1975/2004
650	Management	63	23	0/742	<1	0/3	1988	1968/2004
660	Chemical engineering	62	7	0/57	<1	0/2	1987	1969/2004
670	Manufacturing	63	5	0/25	<1	0/4	1985	1965/2004
680	Manufacture for specific uses	62	18	0/224	<1	0/10	1985	1971/2004
690	Building	63	7	0/46	<1	0/10	1987	1970/2004
All 600s		65	556	2/3463	39	0/200	1988	1976/2004

Table 3. Nonbook media in respondents' science, mathematics, and technology collections

Resource	Number Responding (N)	Number of resources (M)	Years subscribed and Age (M)
Print periodical subscriptions	43	6	
Web-based journal and magazine databases	61	4	4.5
Web-based reference resources	59	4	4
Networked CD-ROM reference resources	48	<1	2
Single-user CD-ROM reference resources	48	8	4
Video and DVD	58	153	10
Streaming video service subscriptions	73	1	2

Table 4. Collaborative encounters between respondent SLMSs and science and mathematics teachers.

Frequency	Number Responding (N)	Science Teachers (n/%)	Mathematics Teachers (n/%)
Once a week or more	73	4/6	0/0
A few times per month	73	17/23	2/3
Once a month or less	73	39/53	31/42
Never	73	13/18	40/55

Table 5. Respondents' perceptions of their professional roles in relation to science and mathematics teachers

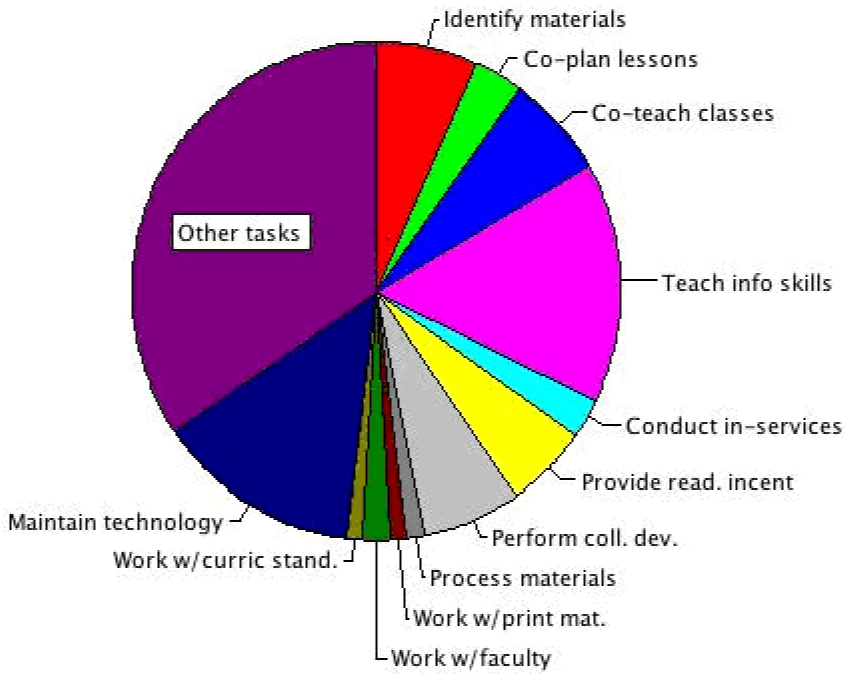
Information Power Role	Number responding (N)	Not Important (n/%)	Somewhat important (n/%)	Important (n/%)	Very important (n/%)
Teacher	72	2/3	4/5	25/35	41/57
Instructional Partner	70	9/13	3/4	33/47	25/36
Information Specialist	71	4/6	0/0	15/21	52/73
Program Administrator	72	7/10	7/10	30/41	28/39

Table 6. Survey variables with significant relationships to 2002 eighth grade science MEAP scores

Survey Variable	Number responding (N)	Correlation *(R)*	Significance *(p)*
Mathematics periodicals	22	.540**	.009
General Science periodicals	34	.531**	.001
Paleontology periodicals	20	.528*	.017
Astronomy periodicals	22	.484*	.023
Life sciences reference	38	.437**	.006
Chemistry periodicals	22	.424*	.049
Web journal and magazine databases	50	.350*	.013
Total reference 600s	43	.336*	.030
Collaboration with science teachers	60	.325*	.011

* $p = 0.05$ (2-tailed)
** $p = 0.01$ (2-tailed)

Figure 1. Professional tasks frequently performed by survey respondents



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