Every Flower in the Garden: Collaboration Between School Librarians and Science Teachers

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Both the teaching profession and the school library profession emphasize collaboration as a way to improve teaching and learning. However, K-12 school librarians rarely collaborate with science teachers. This article reviews publications related to collaboration between science teachers and school librarians. Themes that emerged from the literature included barriers to collaboration as well as opportunities to collaborate in four areas: traditional literacy instruction, information literacy instruction, classroom technology integration, and connecting science to students’ daily lives. Gaps in the research and suggestions for future study are also included.

Introduction

In the life sciences, the term “mutualism” refers to a symbiotic relationship between two organisms in which both partners benefit. One classic example of such a relationship occurs between bees and flowering plants. The bee, in search of food, lands on a flower in order to drink the nutritious nectar. In the process the bee’s body collects grains of pollen, and when the bee arrives at the next flower, some of those pollen grains fall off, fertilizing this second plant. The bee gets to eat, and the plant gets to reproduce. This relationship is so beneficial for both parties that they have each evolved in ways that facilitate the pollination process: bees have developed feathered hair that is more efficient at trapping pollen, and flowers have developed sturdy “landing pads” and ultraviolet coloration to attract the bees.

If schools can be thought of as gardens, as a recent book for school librarians suggests (Abilock, Fontichiaro, & Harada, 2012), then perhaps school librarians should be thought of as bees, buzzing among flowers (teachers) with pollination (learning) as the ultimate outcome. In such a collaborative environment, school librarians and teachers both benefit, and over time, each can evolve their skills and practices to make their relationships more efficient and fruitful. Yet evidence from school library literature suggests that some flowers in the school garden are rarely visited by the bees. Science teachers, in particular, are infrequent collaboration partners with school librarians. This is despite the fact that in several key dimensions, the needs and priorities of school librarians and science teachers display significant overlap.

This paper reviews articles related to collaboration between school librarians and K-12 science teachers and is organized into the following sections based on themes that emerged from the literature: a discussion of the current lack of collaboration between science teachers and school librarians and potential reasons for this deficiency, identification and elaboration of four types of
successful collaborative efforts described in the literature, barriers to this type of collaboration, and gaps in existing research.

**Librarian – Science Teacher Collaboration**

Collaboration between teachers and school librarians has been defined in a variety of ways. It is commonly presented as a continuum that varies from low-intensity resource sharing (what Montiel-Overall (2005) called “coordination”) at one end to high-intensity co-planning, co-teaching, and co-assessment (referred to as “integrated curriculum”) at the other end. Montiel-Overall (2005) defined collaboration as “a trusting, working relationship between two or more equal participants involved in shared thinking, shared planning, and shared creation of innovative integrated instruction…in order to improve student learning in all areas” (p. 32, emphasis in original).

The critical role that collaboration can play in student learning is emphasized in both the education field and in the library science field. Within education, collaboration among classroom teachers is heavily emphasized in professional literature and highlighted in teacher professional standards in many countries (Leonard & Leonard, 2003). In the school library field, teacher/librarian collaboration has been a major focus of research over the past two decades. The influential Information Power guidelines for school library media programs released by the American Association of School Libraries (AASL) describe collaboration as “a key theme in building partnerships for learning” (American Association of School Librarians, 1998, p. 50). A number of studies have connected teacher/librarian collaboration with increased student achievement (e.g. Achterman, 2008; Lance, Rodney, & Russell, 2007), suggesting that there are significant benefits for schools that facilitate this collaboration.

With collaboration so heavily emphasized for both teachers and school librarians, one might expect that all teachers would collaborate frequently with their school librarian to plan, implement, and evaluate instruction. However, this does not seem to be the case for science educators. Former AASL President Nancy Everhart, in an introduction to a science-themed issue of Knowledge Quest, called science teachers “hard nuts to crack when it comes to collaboration” (2010, p. 6).

Research suggests that the source of this issue may lie equally with the science teachers and the school librarians themselves. Science teachers, like educators in other subject areas, may be unaware of the instructional and collaborative roles of the school librarian (Miller, 2004). In addition, science teachers in the United States may be particularly reluctant to invest time in collaborative efforts because a comparatively high percentage of them are new teachers who are teaching out-of-field and thus might be struggling to keep up with the daily demands of practice (National Science Board, 2012). It is important to note that this might not be the case for science teachers in all countries; the 2011 Trends in International Mathematics and Science Study (TIMSS) report found that globally, “most students had teachers that reported having at least ten years of teaching experience, being very well prepared to teach the TIMSS science topics, and feeling very confident in teaching science” (Martin, Mullis, Foy, & Stanco, 2012, p. 285). On the other side of the collaborative relationship, school librarians, many of whom come from humanities backgrounds, may lack scientific content knowledge and thus may feel unprepared to collaborate with science teachers (Mardis, 2005a). Compounding this problem is the fact that professional literature in the school library field, an important source of professional development for school librarians, rarely publishes substantive articles related to science (Mardis, 2006).

Schultz-Jones and Ledbetter (2009) examined the factors contributing to the lack of collaboration between science teachers and school librarians in a mixed-methods study that included survey and interview data from science teachers as well as surveys, interviews, and social network analysis of school librarians. Their results confirmed that lack of collaboration is a
bidirectional problem. The 24 science teachers in the study had little conception of the school librarian’s job beyond cataloging, managing, and retrieving resources. None of them reported receiving any instruction in their teacher education classes related to collaboration with school librarians, and most were unaware of the training that school librarians receive. One teacher commented “I never thought of the position as being more than checking books in and out, and I certainly didn’t realize that [the librarian] was trained as a teacher” (p. 30). The most commonly-cited barrier to collaboration among science teachers was lack of time. Among the five school librarians in the study, none reported designing course content, teaching, or evaluating results with any of the science teachers in their schools. At least in this study, though, the librarians attributed the lack of collaboration with science teachers not to their own lack of science content knowledge but rather to a lack of understanding on the part of the science teachers about what the library could do for them.

The lack of collaboration between science teachers and school librarians is surprising when viewed from a perspective that emphasizes commonalities between these two professional groups. Abilock (2003) pointed out that science and librarianship share a focus on inquiry-based instruction, and many dispositions emphasized in science standards align well with those in standards for information literacy. Furthermore, she noted that science teachers ought to be particularly open to the idea of collaborative teaching, given their awareness of the ways in which practicing scientists typically work in synergistic teams (Abilock, 2003). In fact, successful collaborations between science teachers and school librarians do exist, and they are sometimes described in library science publications, although empirical studies (qualitative or quantitative) are rare. These publications suggest that there are at least four main areas in which collaboration between science teachers and school librarians is (or could be) especially beneficial: instruction related to traditional literacy, instruction related to information literacy, technology integration, and connecting science to students’ daily lives.

**Traditional Literacy Instruction**

As repositories of print materials, school libraries have long been associated with reading. Even as the school library has taken on more responsibilities in terms of school technology leadership and information literacy instruction, one of its core goals remains to “promote reading as a foundational skill for learning, personal growth, and enjoyment” (American Association of School Librarians, 2009, p. 21). Consequently, school librarians often collaborate with language arts teachers on lessons focused on traditional literacy instruction, for example literature circles, writing workshops, and readers’ theater (for an example of this type of collaboration, see Beard & Antrim, 2010). With the recent adoption of the Common Core standards in the United States, though, literacy instruction is no longer the sole province of language arts teachers. Indeed, the English Language Arts Common Core standards “insist that instruction in reading, writing, speaking, listening, and language be a shared responsibility within the school” (National Governors Association Center for Best Practices, 2010, p. 5). The standards document includes benchmarks for literacy in science “to help students meet the particular challenges of reading, writing, speaking, listening, and language” within this discipline (p. 3). As previously discussed, science teachers may already feel overburdened by their existing science curriculum, and librarians may not feel confident providing instruction in science content. A collaborative project focused on reading and/or writing in science would allow both collaborative partners to draw on their respective strengths while also easing them into instruction in a content area that is unfamiliar to them.

One example of such a project is the “diary of an animal” collaborative project described by Buzzeo (2006). Buzzeo, an elementary school librarian, collaborated with several teachers on a
science unit based on the children’s book Diary of a Worm by Doreen Cronin. After reading this book, students researched an animal of their choice and created their own illustrated diaries based on their findings. The collaboration involved the librarian, who was responsible for teaching and evaluating the research and writing aspects of the project; the classroom teacher, who was responsible for teaching and evaluating the science content, including standards related to biomes, food webs, and animal behavior; an art teacher, who taught and evaluated the illustration component of the project; and a computer teacher, who assisted students with online research and computer presentation software. This project involved several aspects of traditional literacy instruction: comprehension of the original mentor text, extraction of information from scientific informational texts during the research phase of the project, and writing an informational / entertaining final product. It allowed the classroom teacher to utilize her knowledge as a science content specialist and the librarian to apply her expertise in reading and writing instruction.

**Information Literacy Instruction**

Popular media is replete with stories bemoaning the low scientific literacy rates of the American public, including school-age children and teens. One recent article proclaimed “Teens Get Failing Grade on Understanding Climate Change” and reported the results of a Yale study finding that only one-fourth of American teens received a passing grade on their awareness and understanding of climate change (Welsh, 2011). To be sure, such lack of understanding derives at least partially from a lack of scientific content knowledge. However, controversial scientific issues such as climate change, evolution, and genetic modification are often discussed and reported outside of the science classroom through a variety of media, making an individual’s evaluation of these issues as much a question of information literacy as science content knowledge.

Julien and Barker (2009) studied high school students’ information literacy skills in a science context, examining how the students went about finding and evaluating information for an in-class biology assignment. Science classrooms, they argued, are an ideal environment in which to teach information literacy skills because of the similarities between the information seeking process and scientific inquiry. While the students in the study reported a high level of confidence in their information retrieval and evaluation abilities, their demonstrated skill level was poor. They relied almost exclusively on the Internet for their information despite the availability of print resources and confused accessibility with reliability, as evidenced by this student’s remark: “[the Internet is] more reliable than going to the library and trying to find a book...cause it takes less time” (p. 3). Their search and evaluation skills were deemed “unsophisticated” by the researchers, who noted that students often simply pasted assignment questions into Google and could not articulate why they deemed a particular site more reliable than an alternative site. This study highlights information literacy instruction as a potentially fruitful area for collaboration between science teachers and school librarians. As with traditional literacy instruction, collaboration in this area would take advantage of each partner’s strengths (content knowledge and science pedagogical knowledge for the science teacher, information literacy pedagogical knowledge for the librarian) and would address a critical area of need for students.

An example of such collaboration is described by Abilock and Lusignan (1998), in which a school librarian and science teacher partnered to teach a collaborative project-based unit on global warming. The two educators worked together to plan and implement a unit in which their students took on the viewpoint of a participant in the Kyoto Conference, investigating and developing arguments from a range of perspectives including industry, environmental groups, and scientific research. The project culminated with a school “Conference on Climate Change,” in which students presented their findings to an assembled group of their peers, parents, teachers, and administrators. They also wrote and sent letters to government officials and examined
coverage of the actual Kyoto Conference as it occurred. Throughout this process, the school librarian and the science teacher worked collaboratively to plan, implement, and evaluate the project. The science teacher utilized her expertise in content knowledge while the school librarian utilized her expertise in information literacy, and both were essential to the success of the project. The authors echoed Abilock (2003) by pointing out the similarity of their two professions: “the disciplines had an analogous set of process skills -- particularly between individual scientific investigations during science projects and information problem-solving during library research. This particular curriculum became an opportunity to flesh out the similarities and differences -- a place for us to learn” (p. 42).

**Technology Integration**

Integrating technology into the classroom has been a major focus across all subject areas in recent years, and science is no exception. Since 1999, the official position of the National Science Teachers’ Association has been that “computers should have a major role in the teaching and learning of science” (National Science Teachers Association, 1999). Research has shown that particular types of technology tools may be especially effective in teaching scientific thinking and habits of mind. Video games, for example, have been shown to help develop specialized vocabulary, systems and model-based reasoning, and collaborative problem solving (Gee, 2009; Steinkuehler & Duncan, 2008). Yet despite this evidence and despite rapid advances in technology along with lowered costs, teachers across all subject areas have been slow to fully integrate technology into the curriculum (Cuban, 2003; Keengwe, Onchvari, & Wachira, 2008). Reasons for this include lack of time to learn about or teach students to use new technologies, lack of access, lack of professional development, pressures related to standardized testing, and a sense that some technologies are simply not practical for classroom use, among other concerns (Cuban, Kirkpatrick, & Peck, 2001; Keengwe et al., 2008; Shirley, Irving, Sanalan, Pape, & Owens, 2010; M. M. Subramaniam, Ahn, Fleischmann, & Druin, 2012).

Technology adoption has also been a major focus within the school library field and is stressed in the American Association of School Librarians’ most recent guidelines for school library media programs (American Association of School Librarians, 2009). Unlike typical classrooms, school libraries represent a “uniquely different space that might foster new innovations.... these spaces are often less tied to the pressures faced in formal classrooms, such as the need to adhere to standardized tests or requirements” (Subramaniam et al., 2012, pp. 168-169). In addition, school libraries often already serve as media and technology hubs, storing both physical and digital technology resources for the school (Subramaniam, Ahn, Waugh, & Druin, 2012; Subramaniam et al., 2012). And while library science literature may only rarely publish articles focusing on collaboration with science teachers, reviews and highlights of science resources, including digital resources, are more common (Mardis, 2006; for examples of articles highlighting digital science resources, see Harper, 2008 and McIlvain, 2010). In sum, as Johnston (2012) stated, “Teacher librarians are in a unique position, due to knowledge of pedagogical principles and curriculum, paired with technology and information expertise, to serve as leaders and valuable assets through making meaningful contributions toward the integration of technology” (p. 18).

One example of a collaborative science project involving technology integration involved an afterschool program in school libraries for underserved middle school students that leveraged students’ interest in popular science media including science fiction novels and movies, graphic novels, and science-related games (Subramaniam et al., 2012). Using these materials as a starting point, the program (called Sci-Dentity) engaged students in storytelling and dialogue with each other both in the offline world and in a project-specific social network (http://www.sci-dentity.org/). Using the social network, students could create a personalized profile, share their
work, communicate with their peers, and even remix the stories of other contributors. New media tools were integrated into all aspects of the Sci-Dentity program: in one session, “students may watch online videos about storm chasers, read comic books about mutant super-powers, find science facts via apps on an iPad, and integrate these sources into their sci-fi stories” (p. 25). While this specific project involved collaboration between school librarians and university researchers, similar endeavors could be quite successful with school librarians and K-12 science teachers. Some of the Sci-Dentity program developers summarized the connections among science education, technology, and the school library in another paper:

Researchers have found that young people develop their personal identities, share knowledge or information with peers, and collaboratively solve problems with their networks…. These literacy practices are not only salient in social contexts but also are vital practices of science communities. Thus, new media tools such as online communities and networks might be leveraged to create ideal hybrid spaces [in school libraries] where students can connect their personal interests and identities to STEM learning activities. (Subramaniam et al., 2012, p. 167)

**Connecting Science to Students’ Daily Lives**

Finding connections between the official curriculum and students’ daily lives is an essential component of inquiry-based principles of learning and teaching, but this task is not always easy or straightforward. How can a teacher connect an esoteric science concept – say, orbital configurations of electrons – to students’ existing interests and prior knowledge? This question is at the heart of several of the library science articles devoted to collaboration between the science teacher and the school librarian.

Connecting science content to students’ daily lives requires first that educators know how students choose to spend their time outside of school. According to a recent U.S. study, the best answer to that question might be “engaging with media” – a national survey of more than 2,000 youth ages 8 to 18 found that children and teens in this age group spend an average of 7.5 hours each day consuming media, and that does not count time they spend with media in school (Rideout, Foehr, & Roberts, 2010). Even more astonishing, when you separate instances of multitasking, the average amount of time rises to 10 hours and 45 minutes per day. This media consumption includes watching television and movies, listening to music, using the computer, playing video games, and yes, reading print material.

Education research has already established links between some of this media and science content. For example, several articles focus on the potential of science fiction for teaching science fact (Czerneda, 2006; Kilby-Goodwin, 2010; Murphy, Mogus, & Crotty, 1998); it is worth noting that none of these articles mention the school librarian or library! Other articles, already mentioned above, explore the potential of video games for teaching science-related content and habits of mind (Gee, 2009; Steinkuehler & Duncan, 2008). The library science field has also keyed into media as a potential way to connect students’ existing interests to science content, and to show them the ways in which their existing interests already incorporate science: “Science is embedded in almost every aspect of the world…. Young people need guidance to link what already interests them about their world to science or to see what is around them through the lens of science” (Subramaniam et al., 2012, p. 169). In other words, if science teachers and school librarians can locate entertaining media resources that have connections to their content, or, even better, if educators can help students create and share that media themselves, a key component of student engagement and motivation will fall into place.

Two articles describe collaborations between school librarians and science teachers that leverage students’ existing media interests to connect science to their daily lives. Okemura (2008), a high school librarian, took part in a collaborative project with a chemistry teacher that leveraged
students’ existing interests in media to teach scientific content. The educators used video clips (such as a scene from The Wizard of Oz) to introduce the idea of “the chemistry behind everyday objects” (p. 48). Inspired by the video clips, students then chose an everyday object that they were interested in (further strengthening the connection between the content and their daily lives), conducted research on the chemical composition of that object, and created visual presentations (another form of media) to share with their classmates. The science teacher and school librarian collaborated throughout this process to plan, implement, and evaluate the unit. Another collaborative unit was proposed by Mardis (2005b), who described how science teachers and school librarians could collaborate to teach units based on crime-scene television shows like CSI. Mardis suggested that in such a unit, the science teacher could serve as the expert on content knowledge (DNA fingerprinting, blood analysis, etc.) while the school librarian could use the television show and related content to help students locate data about real-life crime, teach students about media analysis, locate and catalog cutting-edge digital resources (since forensic science is such a rapidly changing field), and ensure the ethical and legal use of copyrighted media in the school. Mardis also pointed out that since the library is often one of the largest spaces in the school, the school librarian might offer that space for science activities that take up a lot of floor space as a way to open the lines of communication with science teachers. Both of these articles emphasize the potential for science teacher / school librarian collaboration to connect science content to students’ daily lives via their preexisting interests in a variety of media.

Gaps in the Research
Little seems to have changed in the literature since Mardis (2006) reported on the rarity of substantive articles (empirical or anecdotal) focusing on collaboration between science teachers and school librarians. Empirical studies – qualitative or quantitative – are even more rare. More research is needed at every stage of this issue:

- research to identify beliefs and perceptions of pre-service science teachers and librarians regarding collaboration and interventions that might make collaboration more likely once these students transition into practice;
- more research examining barriers to collaboration between science teachers and school librarians and how those barriers might be overcome, similar to the study by Shultz-Jones and Ledbetter (2009), which was limited by small sample size and isolated geographic location;
- more research empirically evaluating both successful and unsuccessful collaboration attempts between science teachers and school librarians; and
- research into how collaborations between science teachers and school librarians impact student achievement.

Conclusion
While the jobs of the school librarian and the science teacher may appear quite different on the surface, the literature reviewed here suggests that these two professions share many of the same concerns and process skills. Barriers to collaboration between science teachers and school librarians are numerous and real; perhaps the greatest of these is a lack of understanding on both sides regarding the content and expertise of the other’s domain. However, opportunities to improve student learning via collaboration are also numerous and real. As the literature reviewed here suggests, there are at least four areas of overlapping needs and skills where science teacher / school librarian collaboration could be particularly fruitful: traditional literacy instruction, information literacy instruction, technology integration, and connecting science to students’ daily lives. Yet many gaps in our understanding of this issue remain. Researchers, school administrators,
and educators must all establish mutualistic relationships to germinate the seeds of collaboration between science teachers and school librarians.

References


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