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Librarian-Teacher Co-Teaching and the Role of School Librarians in Facilitating Inquiry and Maker Learning

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Abstract

The goal of this study was to understand how school librarians and classroom teachers co-teach to facilitate learner-centered instruction, including inquiry and maker learning. Research was conducted through interviews and field observations over three years. In this study, the participating school librarians and teachers worked together throughout the instructional processes—from planning to implementing to assessing. A significant piece of the co-teaching occurred through co-planning, both prior to and throughout the units. During implementation of the units, the school librarians led instruction, provided individual coaching, and assisted with classroom management. The educators collaborated on both formative and summative assessments, before, during, and at the end of the units. The school librarians used various instructional methods grounded in cognitive apprenticeship, such as scaffolding, modeling, mentoring, and coaching. The educators brought differing expertise to the co-teaching relationships. The classroom teachers were the content-area experts, and the librarians' expertise included the processes, approaches, and technologies for the inquiry and maker learning. In these areas, the librarians mentored and scaffolded the classroom teachers. These co-teaching relationships evolved over time, as the teachers gained experience in inquiry and maker learning. The findings suggest librarian-teacher co-teaching significantly facilitates learner-centered instruction in schools.

Introduction

School library guidelines and standards have consistently emphasized the significant role of school librarians as instructional partners and collaborators (AASL, 2007, 2009, 2018; AASL & AECT, 1998). The current national school library standards state that "school librarians are instructional partners and collaborators with other educators in the school library, classroom, and other learning spaces…School librarians provide instruction independently and in collaboration

with educators to meet the learning needs of all learners, including other educators and administrators" (AASL 2018, p. 89). As a specific style of instructional collaboration and partnership, co-teaching occurs when two or more educators bring different expertise and assume complementary roles (Medaille & Shannon, 2012; Roth & Tobin, 2004) to plan, teach, and assess together (Friend & Cook, 2010; Loertscher & Koechlin, 2015; Loertscher & Zepnik, 2019; Medaille & Shannon, 2012), with collective and shared responsibilities (Roth & Tobin, 2004; Tobin, 2006; Villa et al., 2013). Co-teaching allows educators—both school librarians and classroom teachers—to respond to the various needs of students, improve the educator-student ratio, expand their professional expertise, and jointly deliver instruction in ways that are not possible with only one teacher.

The goal of this study is to understand the role of school librarians in co-teaching learner-centered instruction, including inquiry and maker learning, with classroom teachers. Through educator interviews and field observations over three years, the study investigated inquiry and maker units in three public schools—one elementary, one middle, and one high school—in which school librarians actively co-taught with other teachers from different disciplines (language arts, social studies, math, and science). The major research questions included:

- How did the school librarians and classroom teachers co-teach to facilitate inquiry and maker learning?
- What were the roles of school librarians in co-teaching with classroom teachers?
- What were the processes nd approaches to co-teaching?

Conceptually, the study aims to deepen our understanding on co-teaching practices between school librarians and classroom teachers, extending existing knowledge on instructional collaboration and partnership. This paper will inform school librarians, teachers, and administrators who wish to promote co-teaching to effectively facilitate learner-centered approaches in schools about specific methods of co-teaching that might occur between school librarians and classroom teachers.

LITERATURE REVIEW

While librarian-teacher collaboration is an important topic in current school library literature, little research focuses on co-teaching, a specific type of collaboration. This section presents a review of key literature on librarian-teacher collaboration, co-teaching, and instructional partnerships for inquiry and maker learning.

Librarian-Teacher Collaboration

In school librarianship literature, collaboration is often defined in relation to similar concepts, such as coordination or cooperation. Compared to coordination (bringing people together to share information and resources or to schedule activities) and cooperation and partnerships (involving multiple entities working together with division of labor toward similar goals or in similar endeavors), collaboration requires more elaborate processes to plan, implement, and evaluate instructional efforts together with a shared goal (Montiel-Overall, 2008; Todd, 2008).

Montiel-Overall has provided a definition of collaboration in the context of teacher-librarian collaboration:

> Collaboration is a trusting, working relationship between two or more equal participants involved in shared thinking, shared planning, and shared creation of integrated instruction. Through a shared vision and shared objectives, student learning opportunities are created that integrate subject content and information literacy by co-planning, co-implementing, and co-evaluating students' progress throughout the instructional process in order to improve student learning in all areas of the curriculum (2005, p. 5) [Italics from the original text].

Montiel-Overall (2005) proposed models of collaboration for teachers and librarians, which she later called facets (2008), including Facet A: Coordination, Facet B: Cooperation, Facet C: Integrated Instruction, and Facet D: Integrated Curriculum. Facets C and D describe fully developed collaboration efforts, and in Facet D the integrated instruction is found across an entire school or school district. Montiel-Overall suggested these facets are not isolated practices, and each facet has an integral place in the whole process of high-level collaboration.

Research shows a correlation between teacher-librarian collaboration for instruction and student academic achievement (Hughes, 2014). Existing literature identifies instructional partnership as one of the most critical roles of the future of school librarianship, and acting as an instructional partner is one way school librarians enact a leadership role in their schools (Moreillon, 2013). Teacher-librarian collaboration can create unique learning opportunities for learners that may not otherwise be achieved alone, as teachers and librarians bring different expertise and perspectives. While teachers bring content-area expertise, librarians offer expertise in information literacy instruction (Latham et al., 2016; Montiel-Overall, 2005; Phillips & Lee, 2019). Montiel-Overall stated "the library curriculum involves the development of information literacy: knowledge of how to access, evaluate, synthesize, and use information selectively from a wide variety of sources and formats" (2005, p. 7).

In reality, however, collaboration between school librarians and classroom teachers is a daunting task and is not yet a universal practice (Latham et al., 2016; Todd, 2008). Establishing and maintaining collaborative relationships between educators is challenging. Studies identify barriers to collaboration, such as the lack of: time, administrative support, understanding on the role and expertise of school librarians, trusting environments and acceptance for professional differences, and professional development. Structural limitations such as standardized testing, teacher evaluation, and inflexible schedules also provide challenges (Latham et al., 2016; Montiel-Overall, 2008; Rawson, 2014). Factors that make collaboration more successful, on the other hand, include educator personality (being flexible and willing to make changes), expertise, and leadership skills (Montiel-Overall, 2008). School librarians actively desire to work with other educators on instructional processes (Phillips & Lee, 2019), and they use different strategies to reach out to teachers, including providing resource support, focusing on one teacher at a time, and working through intermediaries, such as students and administrators (Latham et al. 2016). Studies suggest the importance of professional development and pre-service education to improve teacher-librarian collaboration (Harada, 2016; Latham et al., 2013; Moreillon, 2013; Moreillon et al., 2014).

Co-Teaching

The existing literature suggests that co-teaching has many benefits. It allows educators to learn from one another, increases educator empowerment and reduces isolation, improves the teacher-student ratio, provides a higher quality of instruction, encourages students to be more cooperative and collaborative, and allows for more individualized teaching and learning (Moreillon & Ballard, 2012; Villa et al., 2013).

While the concept of co-teaching appears in literature on librarian-teacher collaboration, only a very small number of studies strive to identify co-teaching patterns, analyze effective strategies, or provide empirical data on librarian-teacher co-teaching. Loertscher (2014) and his colleagues implemented an unobtrusive and replicable tool via a short questionnaire on a Google form for the purpose of measuring the impact of co-teaching between classroom teachers and school librarians. Their findings, which depended on the participating teachers' reports, suggested that when teachers taught alone in the classroom, about 50% of the students were likely to meet or exceed that teacher's higher expectations. When co-teaching occurred, however, 70%–100% of the students were likely to meet or exceed both the teacher's and librarian's expectations. Loertscher and Zepnik (2019) conducted a replication of the original study in 25 schools and found the same results.

Much of the existing literature on co-teaching comes from the field of special education and focuses on serving diverse learners in blended, inclusive classrooms (Bauwens et al., 1989; Friend et al., 1993; Hang & Rabren, 2009; Murawski & Swanson, 2001; Rice & Zigmond, 2000; Scruggs et al., 2007). Previous research on co-teaching from special education identified different methods of co-teaching, which vary in the approaches and the extent to which the educators teach together. Friend and Cook suggested six co-teaching approaches, including: one teaching, one observing; station teaching; parallel teaching; alternative teaching; teaming; and one teaching, one assisting (2010). Similarly, Villa et al. described four approaches to co-teaching: supportive co-teaching, parallel co-teaching, complementary co-teaching, and team co-teaching (2013).

Instructional Partnerships for Guided Inquiry and Maker Learning

As experts in research-based inquiry processes, school librarians are essential to inquiry-driven instructional frameworks in schools. They empower learners to create new knowledge through inquiry processes that are aligned to each learner's interests (AASL, 2018). Guided Inquiry Design (GID), in particular, is a framework for designing inquiry instruction that is integrated into Pre–K through twelfth-grade curricula. The GID process has eight sequential yet iterative phases:

- Open (open, inspire, and stimulate students' minds and curiosity),
- Immerse (build background knowledge),
- Explore (browse various information sources and explore interesting ideas),
- Identify (develop an inquiry question and form a focus),
- Gather (collect detailed information sources),
- Create (create a presentation of their learning),

- Share (share the product), and
- Evaluate (evaluate student achievements).

Based on Kuhlthau's (2004) Information Search Process (ISP) model, GID has been developed, researched, and implemented in the context of school libraries since the 1980s (Kuhlthau et al., 2015).

A flexible instructional-team approach is necessary to the design and implementation of GID because implementing inquiry learning in schools is multifaceted and requires various sources of expertise: "A team approach to teaching, with principals, supervisors, teachers, and school librarians playing essential roles on the instructional team, was identified as an important element of success" (Kuhlthau et al., 2015, p. 124). For the most effective collaboration, GID recommends forming three-member core teams, which include a school librarian, a classroom or content-area teacher, and one additional team member, who could be another classroom or content-area teacher, or a specialist in literacy, technology, arts, or another field. The core team members collaborate from the beginning to the end (i.e., develop learning objectives, design the unit, and guide and assess the learning). Extended teams may include experts from within the school or community, and these experts join in as needed throughout the process. School librarians are key players in GID, and their main roles include:

- resource curator, who curates resources for inquiry, provides high quality library resources, extends access to outside resources;
- information literacy specialist, who provides information literacy expertise, promotes learning from a variety of sources, models lifelong learning; and
- collaboration catalyst, who provides a technology-infused learning environment, collaborates on all learning teams, and keeps communication flowing (Kuhlthau et al., 2015).

Maker learning, a hands-on learning approach through which learners create, design, tinker, experiment, and share projects with a range of technologies, is increasingly popular in schools. The growing body of literature on maker learning suggests people learn as they make and share hands-on projects (Halverson & Sheridan, 2014; Koh et al., 2019; Loertscher, et al., 2013; Maker Education Initiative, 2018; Peppler et al., 2016a, 2016b). Maker learning has a number of characteristics, such as collaboration; distributed teaching and learning; an expectation to share information and ideas; experiential learning with rapid prototyping; flexibility; and open, accessible, and tools- and media-rich learning environments, among many others (Clapp et al., 2017).

Facilitating maker learning frequently requires expertise beyond the classroom and the school, because learners pursue a range of maker projects based on their personal interests and creativity. Therefore, seeking out and connecting with experts in the community is strongly encouraged and even necessary. In successful maker-centered learning, community members are often invited to share their knowledge and expertise to inspire learners. Programs that identify and connect people in the community, such as tinkerer/maker/artist-in-residence programs, are an important element of facilitating making (Halverson et al., 2017). Research on school librarians' experiences with maker learning and their changing roles is, however, still emerging

(Moorefield-Lang, 2018; Phillips et al., 2019). More research is needed regarding the role of school librarians, including their collaborative partnerships, to enable successful maker learning in schools.

Overall, in school librarianship research and practice, librarian-teacher collaboration has consistently been emphasized as one of the most critical areas. There is, however, a lack of research that particularly focuses on co-teaching in the context of school librarianship. Little is widely known about the processes of co-teaching and the roles of school librarians as they co-teach with classroom teachers. Educators and administrators may recognize the benefits of co-teaching, but owing to the lack of literature and published theory that explain and share specific co-teaching approaches, people may not know where to start or how to effectively co-teach. In addition, according to the literature, inquiry and maker learning approaches seem to offer unique opportunities for instructional partnerships and co-teaching; more research is needed to illuminate the role of school librarians in facilitating such learner-centered approaches in school.

Research Design

STUDY CONTEXTS

The study presented in this paper is part of a three-year design-based research project that investigated inquiry and maker learning in formal school curricula. Design-based research is conducted to advance theoretical knowledge and practical solutions simultaneously through the iterative development of solutions to practical problems, working with stakeholders in real-world contexts (Brown, 1992; Brown & Campione, 1996; Cobb et al., 2003; McKenney & Reeves, 2019). The real-world problems addressed in this project included the need for designing creative learning approaches that increase learners' interest, self-regulation, and engagement within standards-based curricula. Along with implementing existing inquiry instruction (i.e., Guided Inquiry Design [GID]), the project team designed and implemented inquiry-based maker learning (i.e., integration of the maker mindsets and processes into Guided Inquiry Design, referred to as GIDM in this paper). One of the major research questions concerned how school librarians and classroom teachers collaborate and co-teach to deliver inquiry and maker learning.

The project was conducted in a mid-size suburban community in the south-central region of the U.S. between 2016 and 2019. The project team consisted of researchers from library and information sciences and learning sciences, as well as school administrators (director of libraries and instructional technology, assistant superintendent, and technology integration specialist) and a project manager from the public school district. The team selected three schools—one elementary, one middle, and one high school—with diverse student populations, including higher than average (within the district) percentages of special education students, ELL (English Language Learners) students, and students from lower socio-economic groups. Each school has at least one full-time school librarian with a master's degree from an American Library Association-accredited program.

Administrators and school librarians from each school decided which grades and subjects would be best suited for the purpose of the project, and they recruited classroom teachers and special education or gifted resource teachers to join. The team of educators from each school designed

and implemented inquiry (GID) and inquiry-based maker (GIDM) units. The project team offered a series of professional development sessions and debriefing meetings; provided technical, instructional, and administrative assistance; and conducted the research activities, including field observations, surveys, interviews, and artifact analysis.

Over three years, the researchers in the project team (the first two authors) investigated both the regular inquiry units (GID) and inquiry-based maker units (GIDM). A total of 35 units were implemented over the three years, with over 400 students enrolled in the participating classes. There were 18 GID and 17 GIDM units. (One additional GIDM unit was not included in the study because a teacher dropped out of the study). The subjects included social studies, science, language arts, and math. See Table 1 for more information about the units. Both the GID and GIDM units followed the same eight-phase Guided Inquiry Design process (Open, Immerse, Explore, Identify, Gather, Create, Share, and Evaluate) and shared many similarities, although the GIDM units were more open-ended, hands-on, technology-rich, and individualized, especially the types of final products.

While this was a multi-faceted project that investigated various aspects of inquiry and maker learning in schools, this paper specifically focuses on the roles of the participating school librarians as they collaborated to design and implement inquiry and maker learning. Comparing GID and GIDM is beyond the scope of this paper, unless specifically related to the ways in which the educators co-taught. The project was approved by an Institutional Review Board (IRB). Qualitative data collection and analysis methods were chosen because of the exploratory nature of the study on co-teaching by school librarians and due to the aim of capturing the perspectives and experiences of the educators in their own words.

DATA COLLECTION

The major data sources for this paper included group and individual interviews and observations. The researchers conducted a series of 29 interviews at three points throughout the study (at the end of the Spring 2018, Fall 2018, and Spring 2019 semesters) with the educators who participated in the project. A total of 25 educators were interviewed—including 5 school librarians, 18 classroom teachers (4 language arts; 2 social studies; 4 science; 2 math; and 6 elementary school teachers), and 2 gifted-resource coordinators—from three public schools (one elementary, one middle, and one high school). Different classroom teachers participated each year. Throughout the entire three-year project period, the school librarians remained the same (except for the replacement of one high school librarian). Therefore, each school librarian was interviewed at least two or three times. All educators facilitated both GID and GIDM units in this project. See Table 1 for information about the participating educators and the units that they implemented during the project.

Table 1

SPRING 2018[a]					
School	Grade/ Position	Unit Name	Subject	GID or GIDM	Group or Individual Interview
Elementary School	2nd Grade Teacher	Civil Rights Symbols	Social Studies	GID	Group of the two 2nd grade teachers
		Pollinators	Science	GIDM	
	2nd Grade Teacher	Civil Rights Symbols	Social Studies	GIDM	
		Pollinators	Science	GID	
	Elementary School Librarian	N/A (work across all units/subjects)			Individual interview
Middle School	7th Grade Language Arts Teacher	Taking a Stand	Language Arts	GIDM	Group of the two 7th grade teachers
		Peace Prescription	Language Arts	GID	
	7th Grade Language Arts Teacher	Taking a Stand	Language Arts	GID	
		Peace Prescription	Language Arts	GIDM	
	Middle School Librarian	N/A (work across all units/subjects)			Individual interview
High School	10th Grade Language Arts Teacher	Social Justice	Language Arts	GIDM	Group of the two 10th grade teachers
		Culture & World Literature	Language Arts	GID	
	10th Grade Language Arts Teacher	Social Justice	Language Arts	GID	
		Culture & World Literature	Language Arts	GIDM	
	High School Librarian	N/A (work across all units/subjects)			Group of the two high school librarians
	High School Librarian				

FALL 2018					
School	Grade/ Position	Unit Name	Subject	GID or GIDM	Group or Individual Interview
Elementary School	1st Grade Teacher	Inventors	Social Studies	GIDM	Group of the two 1st grade teachers
	1st Grade Teacher	Inventors	Social Studies	GID	
	5th Grade Teacher	Disruptions (Ecosystems)	Science	GID	Group of the two 5th grade teachers
	5th Grade Teacher	Disruptions (Ecosystems)	Science	GIDM	
	Elementary School Librarian	N/A (work across all units/subjects)			Individual interview
	Elementary School Gifted Specialist	N/A (work across all units/subjects)			Individual interview
Middle School	6th Grade Social Studies Teacher	Physical Systems	Social Studies	GIDM	Group of the two 6th grade teachers
	6th Grade Social Studies Teacher[b]	Physical Systems	Social Studies	GID	
	8th Grade Science Teacher	Earth & Human Interactions	Science	GIDM	Individual interview[c]
	8th Grade Science Teacher	Earth & Human Interactions	Science	GID	Individual interview
	Middle School Librarian	N/A (work across all units/subjects)			Individual interview
	Middle School Gifted Specialist	N/A (work across all units/subjects)			Individual interview
High School	High School Math Teacher	Quadratics	Math	GID	Group of the two high school math teachers
	High School Math Teacher	Quadratics	Math	GIDM	
	10th Grade Science Teacher	Alternative Energy Sources	Science	GID	Group of the two 10th grade teachers
	10th Grade Science Teacher	Alternative Energy Sources	Science	GIDM	

	High School Librarian	N/A (work across all units/subjects)			Group of the two high school librarians
	High School Librarian	N/A (work across all units/subjects)			
SPRING 2019					
School	Grade/ Position	Unit Name	Subject	GID or GIDM	Group or Individual Interview
Elementary School	1st Grade Teacher	Animal Adaptations	Science	GID	Group of the two 1st grade teachers
	1st Grade Teacher	Animal Adaptations	Science	GIDM	
	5th Grade Teacher	Unification	Social Studies	GIDM	Group of the two 5th grade teachers
	5th Grade Teacher	Unification	Social Studies	GID	
	Elementary School Librarian	N/A (work across all units/subjects)			Individual interview
Middle School	6th Grade Social Studies Teacher	Environmental Challenges	Social Studies	GID	Individual interview
	8th Grade Science Teacher	Waves	Science	GID	Group of the two 8th grade teachers
	8th Grade Science Teacher	Waves	Science	GIDM	
	Middle School Librarian	N/A (work across all units/subjects)			Individual interview
High School	High School Math Teacher	Social Justice Statistics	Math	GIDM	Group of the two high school math teachers
	High School Math Teacher	Social Justice Statistics	Math	GID	
	9th Grade Science Teacher	Waves & Digital Technology	Science	GIDM	Group of the two 9th grade teachers
	9th Grade Science Teacher	Waves & Digital Technology	Science	GID	
	High School Librarian	N/A (work across all units/subjects)			Group of the two high school librarians
	High School Librarian	N/A (work across all units/subjects)			

[a] Teachers who participated in Spring 2018 delivered 2 units in that semester—one GID unit and one GIDM unit. In Fall 2018 and Spring 2019, a new group of teachers participated, and each teacher delivered one unit per semester; for example, a GID unit in the fall and a GIDM unit in the spring, or vice versa. The same school librarians participated in all three semesters, except for one of the high school librarians.

[b] One of the 6th grade science teachers participated in Fall 2018 but did not participate in the research in Spring 2019.

[c] Individual interviews were conducted for the 8th grade teachers in Fall 2018 and Spring 2019 due to an audio recording consent issue.

The duration of each interview was between a half hour to over one hour. The interviews were conducted in person at each school, either with a group of two educators who taught the same subject or individually (e.g., a single school librarian). The interviews were performed by the researchers who had visited the classes for field observations, and were, therefore, familiar with the units and had built a strong rapport with the educators.

The interviews were semi-structured. Major interview questions included the educators' overall experiences and perceptions of implementing GID and GIDM units; the benefits, challenges, and successful strategies for the learning approaches; student performance; educational goals; and more. Specific questions about instructional collaborations were asked, including: "Tell us about how you worked with librarians (or classroom teachers) to design and implement the GID or GIDM units." The librarians were asked about their perceived roles in those units. Since all librarians but one stayed throughout the entire three years, working with different teachers, the researchers asked the librarians to compare their experiences and reflect on changes over time. The librarians were asked additional questions about teaching information literacy and inquiry skills. See Appendix A for the list of interview questions. Questions were slightly modified and personalized during the interviews, depending on the subject, grade, and unit, and follow-up questions were asked.

All interviews were audio-recorded and transcribed, except for one teacher who did not consent to be recorded; in that case, detailed notes were taken. Supplementary data came from the field observations. One or both of the researchers visited each unit at least once or twice a week, and unobtrusively observed the class sessions and took field notes. When desirable, the field notes included photos of the field and teaching materials. See Appendix B for the field observation template.

DATA ANALYSIS

In addition to the two researchers who conducted interviews and field observations for the three years, an additional researcher, the third author of this paper, who had not been in the field joined for qualitative data analysis and provided an objective point of view and enhanced the reliability of the data analysis. The researchers had a weekly data analysis meeting and shared analysis notes on a secure web-based drive on Box.com. All transcribed interviews were uploaded to and coded on Dedoose, a web-based mixed-method data analysis application.

Multiple cycles of coding were conducted. The analysis processes were iterative and used both inductive and deductive approaches (Hsieh & Shannon, 2005; Zhang & Wildemuth, 2017). The researchers immersed themselves in the data to allow emergent themes inductively (the first round of open coding) and grouped the initial codes into a smaller number of categories and themes (the second round of axial coding). At the same time, the existing findings and frameworks from previous literature informed the analysis to see if and how our findings confirm, dispute, or extend the existing body of knowledge.

Categories emerged from the data, as well as sub-themes for each category. The processes also included cross-case analysis by synthesizing data from multiple units to find commonalities and differences among teachers, grades, schools, subjects, and semesters. Once the major patterns and themes were identified, the researchers generated assertions and connected sets of statements.

Findings

The findings in this paper include the specific roles of the school librarians as they:

- took part in the processes of co-teaching with the classroom teachers, including co-planning, co-implementing, and co-assessing;
- brought in expertise on the inquiry processes and maker technologies and mindsets; and
- supported both students and teachers throughout the inquiry and maker units.

Representative excerpts from the interviews are cited with the following information: the semester during which the interview took place (e.g., "SP18" for spring 2018), the level at which the educator taught ("ES" for elementary school, "MS" for middle school, and "HS" for high school), and the educator's position (e.g., librarian, math teacher, 2nd-Grade Teacher, etc.).

CO-TEACHING PROCESSES AND STRATEGIES FOR STUDENTS

This section details the roles of the school librarians as co-teachers throughout the co-planning, co-implementation, and co-assessment processes of the inquiry and maker learning, for the purpose of supporting student learning.

Co-Planning

A significant piece of the co-teaching between school librarians and classroom teachers occurred through the process of planning, both prior to and throughout the units. Teachers and librarians participating in the study agreed that co-planning was essential for the success of the units. One middle school social studies teacher said, "We were partners in doing it all together because we planned together. We had different ideas that we put together…We were a team" (SP19 MS Social Studies Teacher). A high school librarian's statement concurred: "I think it's very important to be involved from the beginning in the planning process—planning with the teachers" (SP19 HS Librarian).

A substantial amount of co-planning took place during meetings between the classroom teachers and school librarians before the units began. The school librarians participated in the instructional design processes, coordination and scheduling, and resource provision and curation. They prepared and created inquiry tools, such as the inquiry journals that were used by the students to record and reflect on their research process. One of the high school librarians described her participation in co-planning the units: "We spent a lot of time planning. I did a lot of scheduling. I put together the Google Docs, the hyper-doc that all the teachers used for the inquiry journal, the inquiry log" (FA18 HS Librarian). Similarly, the middle school librarian described how she and the teachers planned a unit together in half-day planning meetings: "We took the [existing] unit but we broke [it] down and added what works for us and created all of our journals and rubrics and everything together at those meetings. So, I think most of the planning and collaboration happened during those meetings" (FA18 MS Librarian).

Co-planning continued in an unstructured way throughout the units. One high school language arts teacher described this, saying: "I often spent my time in the library, the last few minutes of my plan, talking about what we were doing in class that day, talking to [the librarians] about what I needed from them, what I think my kids needed from them for that particular day. So, the collaboration for me happened very much kind of on the fly, in the moment" (SP18 HS Language Arts Teacher). This continual planning throughout the units was important for adjusting to unforeseen challenges and making changes when the projects did not progress as originally planned. The elementary school librarian said, "There's that back and forth of what's going to work well for kids and for teachers. And so, you have to be on the same page, and you have to be talking and collaborating" (SP18 ES Librarian).

Co-Implementing

The role of the school librarians in co-implementing the inquiry and maker units included leading instruction, providing individual assistance to students, and assisting with classroom management.

Leading instruction. The school librarians led instruction in their expertise areas, which included: development of inquiry questions, introduction to maker technologies, and information literacy skills.

The school librarians led age-appropriate instructional sessions on the development of inquiry questions, which is the focus of the Identify phase of Guided Inquiry. They demonstrated different levels of inquiry questions, such as Level 1–asking who, where, or when, answerable through a simple search; Level 2– asking how, what, or why questions requiring explaining and analyzing; and Level 3–asking questions that require critical thinking and applying knowledge. The librarians also had students practice developing questions.

A first-grade teacher described the instruction the librarian provided to her class to teach about the different levels of questions:

> We did a good activity with [the librarian]. She had a little jack-o-lantern and she taught [the students] what each level of question looked like, and then they had to ask the jack-

> o-lantern the question and if it was that level then she'd plug it in, and the jack-o-lantern would light up. And I think that really helped them to understand the difference between a level one question and a [higher level] question. (FA18 ES 1st-Grade Teacher)

The school librarians also led instruction on the maker technologies, introducing students to the schools' makerspaces and teaching them about the various tools available to them for their inquiry projects. The instruction the librarians provided in the makerspaces allowed the students to experiment with the various maker tools. One high school language arts teacher said:

> [The school librarians] planned a really great breakout session where [the students] were able to work with the tools a bit more, and I think that really, really helped for kids to not struggle so much with what they wanted to make. Most of them knew at least what category of project they wanted to make." (SP18 HS Language Arts Teacher)

In the middle school, besides the actual unit hours, the librarian ran the "Flex" hour, which gave students a less structured time to engage in different tools and activities in the makerspace. During the sessions, the middle school librarian set up the following objective, "To learn how the maker equipment can help us with our Guided Inquiry project" to make sure that the students were mindful of the goal of using the tools to deepen their inquiry learning, answer their inquiry questions, and demonstrate their learning effectively using the maker technologies (SP18 researcher observation).

The school librarians provided instruction on various information literacy skills as well, such as searching strategies, using library materials and databases, how to organize and cite collected information, and source-credibility judgement skills. A high school science teacher described the type of instruction that the librarians provided to her class:

> [The librarians taught the students] about keyword searches and how to find sources, and then they came in and gave a short lesson on how to do in-text citations and how to find resources to cite all of their work." (SP19 HS Science Teacher)

The middle school librarian and one of the high school librarians both described leading what they called "mini-lessons" during the Gather phase on research skills, including search strategies and keywords (FA18 MS Librarian; FA18 HS Librarian). The elementary school librarian described finding a way to model search behaviors for the students through a request from their teacher for an informational video on buffaloes. She said:

> I brought [the video] to her class, but then before we showed it and talked about it and did our activity with it, I said, "So this is how I found it," just to model for everyone, and I was like, "These were my keywords I looked for," and then when I looked along, "I don't know who this person is, so I'm not going to trust them to tell me anything about buffaloes."…So, I walked through that with kids, and I think that you walk through that with any of the technology. (SP18 ES Librarian)

Individual assistance. The school librarians worked closely with individual students. In GID, one-on-one conferencing between educators and students is suggested as an effective means to

clarify confusion, get students quickly back on track, and increase their self-awareness in their use of time, sources, and formulation of a focus for their inquiry (Kuhlthau et al., 2015, p. 150). Each student participated in at least one conference with a teacher or a librarian. The educators reflected positively on the process of one-on-one conferencing. A high school teacher said:

> One of the things that I found the most useful was just the individual conferencing with students and talking with them, because I think that through conversations, a lot of what they have on their mind got more developed. I think they really kind of figured out through talking…what they were interested in and how they could develop a question, and then through these conversations they figured out what they could make. (FA18 HS Science Teacher)

Despite feeling that providing individual assistance to students was a positive and beneficial experience for learning, several classroom teachers reported that it was a challenge to try to meet with each student. One science teacher said, "With the large class sizes, it's really difficult to conference with each individual student" (FA18 HS Science Teacher). Similarly, one math teacher said, "One teacher to thirty kids; there is no way you can be everywhere and help them all in a one-hour period a day" (SP19 HS Math Teacher). The librarians were able to mitigate this challenge by assisting in providing the individual student conferences. One high school teacher reflected on this, saying, "I think the teacher librarian partners are so helpful in that regard. Especially with class sizes the way that they are, it's virtually impossible for us to do that quickly and give kids the attention that they need" (SP18 HS Language Arts Teacher).

The school librarians also worked with a number of individual students in a less structured way through informal coaching. They attempted to identify those students who most needed assistance and the moments in which help and instruction would provide the most benefit for learning. The elementary school librarian said, "You see the kids that are struggling…You look for who needs you and just kind of—you gravitate to them" (SP18 ES Librarian). She described a specific example of working with an individual student who was researching animal vision, but who was finding the available resources to be too technical:

> I tried to touch base with numerous kids, but it's like you team with the teacher…and then check in with who really needs [help]. For instance, I had a student [whose project concerned animal vision] who—a lot of the vision stuff was above their comprehension level, like either the reading or the vocabulary for what was happening in the eye of an animal. And so, those kids I would sit down with and help them do the research, too, as far as here's some resources we can look at, we can have it read to us, and then maybe I might have to kind of reword some of it. (SP18 ES Librarian)

The school librarians strived to identify the moments when students actually needed individual assistance, versus allowing the learning to occur through experimentation and trial and error. By identifying the right moments to provide informal coaching to students, the librarians were able to help students successfully persevere through the common challenges of creating products for the maker units. The elementary school librarian shared a story of helping a specific student at the moment when he was just about to give up on his idea:

> You have kids who start on something, like the boy who made the clay model of a wasp…It wasn't drying quickly enough, and he was worried the antennae were going to wilt, and it made him anxious enough that he wanted to completely leave that project. And he saw kids working on a Piktochart, and [he] was like, "I will make a Piktochart now." I was like, "No, no, no." So, you have to come and support that, too…for the grit and the perseverance on some of these tools to say, "No, this does look good." (SP18 ES Librarian)

Classroom management. Compared to a lecture-based classroom, in which everyone is on the same page, students taking part in inquiry and maker learning frequently work on individualized projects at different paces. This variance of pace caused significant challenges regarding classroom management. These classroom management challenges seemed greater in the maker units than the regular inquiry units because there was so much variety in the types of maker projects to keep track of and because the students were often not all in one location. During the inquiry and maker units, the librarians were able to assist the teachers in the overall management of the classrooms. The high school librarians found that simply being physically present in the classroom was helpful:

> We would try to be present to try and be just an extra body in the room and an extra person who could answer a question or have a conversation with a kid about what they were working on or what they needed. (SP18 HS Librarian)

One high school teacher described how the librarians assisted with managing the class during the hands-on portion of the maker unit:

> During the Create [phase], students were just kind of everywhere, all over the library. They were in the makerspace, and they were working in the classroom space, and there was no way I would have been able to manage all of the students throughout that. And so, having the librarians who were actually physically there in the space while the students were making was really helpful, knowing that someone was helping them and supervising what they were doing, helping them figure out how to solve their problems while I could monitor everybody else's work during the class time. (FA18 HS Science Teacher)

The librarians explained that supporting teachers with classroom management was a crucial aspect of successful co-teaching because the processes of inquiry and maker units were so involved. One high school librarian said:

> It's not necessarily what you would expect the librarian to be helping with, but [the teachers] needed the assistance so we're there for them wherever they need it. (SP19 HS Librarian)

The elementary school librarian also summed this up, saying:

> You never want a teacher to feel like this is all their thing. That's just too much…It's not going to be as effective if it's one person; you've got to cut that ratio down and be coaching kids as much as possible. (SP18 ES Librarian)

Co-Assessing

The school librarians and teachers collaborated on various types of assessments, both formative and summative, before, during, and at the end of the units. They collaborated ahead of time to create rubrics or modify existing rubrics to place more emphasis on the learning process, allowing for more risk-taking and innovation from the students. Assessment of student work was also built into the instructional materials, such as the inquiry journals and makerspace proposals, which became evidence of student learning. Teachers and librarians monitored student progress informally throughout the units through one-on-one conferencing and other monitoring strategies.

The school librarians were engaged in the design of assessments during the planning stage before the units began. At the middle school level, the librarian and a team of teachers held half-day planning meetings during which they created the rubric for assessing student work. The high school librarians also reported that they were engaged most in assessment during the planning stage before the units began (SP19 HS Librarian).

The school librarians participated in formal and informal assessments at various points, yet the role of school librarians in co-assessing varied across the schools and units, particularly with regard to the levels of participation in assessing student work. The middle school librarian said she was involved in grading student work more than ever before during the inquiry and maker units because of her role as a Guided Inquiry coach for the teachers. She said:

> I see it as my role almost in that coaching capacity…So, hopefully [the teachers] feel comfortable and maybe next year if they want to do this again, I won't be involved in that part, but they'll have the tools and they'll know how this is supposed to be. (FA18 MS Librarian)

Other school librarians described different ways of assessing and monitoring student progress throughout the units. Being present at every class for evaluation was a logistical challenge for the librarians due to scheduling and other duties associated with their role in the school. One of the high school librarians said, "It's just not possible for us to be all-in with the evaluation part because there's just so many [students]" (SP19 HS Librarian). To cope with this reality, the high school librarians monitored the Google Classrooms of the participating classes to stay informed on how the students were doing with their projects:

> When [the students] would turn an assignment in, sometimes I would just go into Google Classroom and look at their assignments and see a specific kid that I had talked to and…I want to see what they turned in for a prototype, or what their outline is or whatever it was. And so that was helpful for me to feel like I knew what was going on. (SP18 HS Librarian)

The elementary school librarian informally assessed the progress of the units by checking in with teachers. She said:

> I don't know a teacher in this building that as we go through this process we're not stopping in the halls and discussing what we've done with our inquiry circles. What's worked. What hasn't…It's informal in the halls but I think that that's definitely one way that, as we're going through the process, we're monitoring students and determining how they're doing. (SP19 ES Librarian)

She also described an online document that she and a classroom teacher used together to easily track and monitor student progress on their projects. She said:

> We just made a quick Google Doc where we could say, 'Yes, they're done making'…So, we could track kids together that way and knew how to check on people. So, there's monitoring strategies like that. (SP18 ES Librarian)

COACHING TEACHERS IN THE AREAS OF INQUIRY AND MAKER LEARNING

The educators brought differing expertise to the co-teaching relationships. While the classroom teachers brought expertise in the content-area subjects, the school librarians held the role of coaching the teachers on inquiry processes and philosophies, and training the teachers on makerspace technologies and the maker mindset. The elementary school librarian described this relationship, saying:

> I feel like as much as I'm a coach for the kids, [my role is also] to be a coach for the teachers. And also, I want to learn from them…because we know that when we combine our skill sets, it's going to be more beneficial to kids, either if it's from our perspective or the tools we know how to use. (SP18 ES Librarian)

Inquiry Processes and Philosophies

Three of the participating school librarians, one from each school, were directly trained by the developers of Guided Inquiry Design and became GID trainers for other educators in the district. Therefore, these librarians were well informed in the philosophies and best practices of the inquiry process, whereas the classroom teachers' familiarity with GID varied. One librarian described the expertise gained by working with many classes across the curriculum and over time, saying:

> I think one of our big roles just stems from our ability to see the big picture…We can see the big picture and are able to draw and bring in all of those ideas…We just bring this perspective that, really, I think, broadens what the teachers see as possible. (SP19 HS Librarian)

Our findings show that the classroom teachers acknowledged and relied on the school librarians' expertise in the inquiry process. One high school math teacher said:

> Collaboration [with a school librarian] was really great because while we may be the experts on the math side, and we're versed in Guided Inquiry, I wouldn't call us experts in Guided Inquiry, and so that was very nice to have that partnership. (FA18 HS Math Teacher)

An elementary school teacher remarked about the school librarian: "She's teaching me as well as the kids" (SP18 ES 2nd-Grade Teacher). A statement from one of the high school librarians is consistent with this, as well. She said, "The teacher is the content expert and we're the expert in the design" (SP19 HS Librarian).

School librarians mentored classroom teachers on coaching individual students during the inquiry units. The elementary school librarian emphasized the importance of training teachers on coaching skills when students struggle, which is a natural part of the inquiry learning process:

> We go through the information search process and the struggle with that, because it's hard for teachers to see kids struggle…I love that that's part of the training we do for teachers, that we explain they have to have this disequilibrium to really have learning and understanding, and how to be a guide and a coach but still let kids experience that. (SP18 ES Librarian)

Makerspace Technologies and the Maker Mindset

In each of the three schools in this study, the makerspaces were physically located in the library. The school librarians were frequently viewed as the school experts on the maker technologies, assisting both students and teachers on utilizing the makerspaces. The elementary school librarian commented on her role of training the classroom teachers on the makerspace technologies, saying:

> The tools are here, and I've had the chance to learn. So, I have to kind of equip teachers, too. So, part of my role is supporting teachers so that they can use the tools we have, and what's going to make them feel comfortable.

Referencing the natural struggle that exists in working with maker technologies, she added:

> I think what makes my interactions with technology work so well is that I'm comfortable with being uncomfortable. (SP18 ES Librarian)

The mentality surrounding this struggle, focusing on resilience, creativity, experimentation, problem-solving, and perseverance, is often referred to as the maker mindset. Training teachers on the maker mindset was an important step for the school librarians in building teacher buy-in on the maker process because the educational benefits of making were not immediately evident to all of the educators. One high school librarian explained this hesitancy, particularly among teachers who were new to the concept of makerspaces:

> I definitely think teachers are not super-comfortable with the idea of making as part of their curriculum or their class, because for a lot of teachers, it's really hard to give kids an option to create something that [the teachers] themselves don't know how to create. Or how to grade. "How am I going to grade all of these different things?" And so, I think it's really hard for teachers to allow that in their classrooms…It's too much for a person to do all alone. (SP18 HS Librarian)

The elementary school librarian described her efforts to foster a maker mindset within the school:

> I'd seen makerspaces, but you can't assume your teachers have, and so I had a presentation and we talked about the philosophy of the space and collaborative creation, and how that can inspire genius as you're getting to share ideas and work through this, and how even to some extent mess can inspire creativity. (SP18 ES Librarian)

The librarians modeled the experimentation and resilience of the maker mindset for teachers in hopes that the teachers would similarly model these behaviors for their students. One high school librarian said:

> Every chance we have when we're talking about the makerspace to our staff, our faculty, we always talk about the fact that we don't know how to do everything in it…We're never going to know how to do everything, and that's part of what we want to teach kids is how to work through something that you don't know how to do. (SP18 HS Librarian)

The elementary school librarian described her process of modeling perseverance in the face of technology that isn't working correctly:

> I try to share with teachers, if you're in the front of the room and your technology is just tanking and…you're having trouble troubleshooting, my preference even is to just work through it with kids and use that as a model for a growth mindset and how to deal with the struggle and just be honest and say, "My audio's not working. Let's see, I'm going to think through this. What works; what doesn't." (SP18 ES Librarian)

Dynamic Co-Teaching Relationships

The co-teaching relationships in this study were impacted by the classroom teachers' experience levels with inquiry and maker learning. The school librarians were involved more heavily in the processes of co-teaching if the participating teachers were new to these learner-centered approaches, while the teachers who were more proficient and confident in the inquiry processes and maker technologies tended to rely less on the librarians. One middle school teacher who was new to inquiry and maker learning, said:

> I told my kids, I'm in the same boat as you. This is the first time for me…So, it was nice to have [the librarian] in the background, saying, "This is what we're going to do this week, and this is what you need to expect." So, it was really helpful. (FA18 MS Science Teacher)

One high school librarian said, "When you first do a Guided Inquiry unit with somebody, like the very first time you do it, they need the most supportive help, and then you can kind of wean them off" (SP19 HS Librarian). This gradual reduction in assistance given to the teachers as they became more proficient allowed the librarians time to work with more teachers throughout the semesters. The elementary school librarian described her role in co-teaching the units, highlighting the ways that her involvement changed over time. She said, "[My role] continues to evolve, because when we started doing Guided Inquiry it rested on me for most of it, just from a teacher's comfort level." She went on to reference specific phases of GID, saying "Now teachers feel very comfortable with Open." She observed that the classroom teachers had "taken ownership" of the Gather phase. She summed up her reflection, saying, "I think you have to have some of that flexibility built in, that as you do this for more and more years, and kids' comfort and teachers' comfort improves, it changes. It's going to change" (SP19 ES Librarian).

As the classroom teachers became more familiar with the inquiry processes over the course of the project, they were able to facilitate the units with less assistance from the librarians. A high school math teacher described gaining experience in helping students develop their inquiry questions:

> I've grown a lot…When we first started doing it, we were just like, "Make any question you want about math and real world," and we didn't train [the students] to really figure out what they want to learn [and] what they were interested in. So, I've learned more of how to do that. (FA18 HS Math Teacher)

In the final semester of the study, one elementary school teacher reflected on the ways that her co-teaching relationship changed over time. She said:

> [The librarian] has kind of taught us along the way, so I really feel that by the time we got to this unit…I finally kind of know what I'm doing as far as the process and the steps. So, I think ultimately that's the goal. She's kind of trained us, and she's taught us how to do it. (SP19 ES 5th-Grade Teacher)

The co-teaching relationships were impacted by the classroom teachers' experience levels with the maker technologies, as well. At the end of the first semester of the study, the elementary school librarian reported being the only person who was versed in some of the more complicated makerspace tools, such as Tinkercad:

> It's kind of just me, knowing, you know, Tinkercad, the ins and outs of all that, which hopefully over time, that will change. You know, we're working on setting things in place to train students and train teachers…But that kind of leaves me with coaching everyone that's using technology and walking kids through what works and what doesn't on those programs. (SP18 ES Librarian)

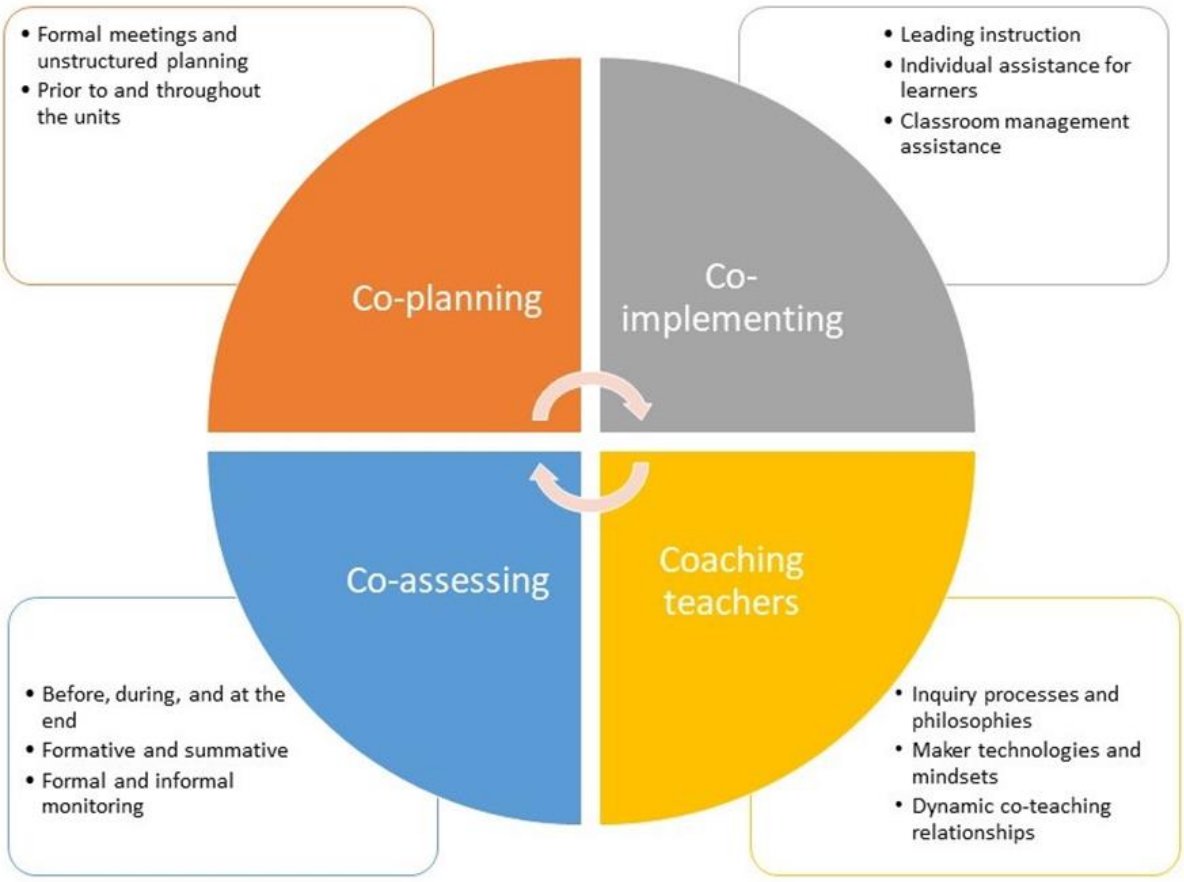
Over time, the teachers were given opportunities to learn how to use some of these maker technologies, reducing the amount that the librarian was relied upon when instructing students on these tools. After the third and final semester of the study, the same librarian reflected on this shift, saying:

> [Initially,] I was the only person that knew how to do the 3D printer or how to use GarageBand…[The teachers had] the chance to come in over the summer last summer and learn some of these tools. I think they're more comfortable, and it…has felt easier as far as working with students because it wasn't me as the only person who knew how to work any of the stuff. (SP19 ES Librarian)

As a whole, our findings show that the co-teaching relationships between the school librarians and classroom teachers were vital to the success of the inquiry and maker units. As one middle school teacher remarked, "I just think makerspace, Guided Inquiry, any of this, if you don't have a librarian backing you, you're not going to be successful" (SP18 MS Language Arts Teacher). Figure 1 illustrates the roles the school librarians played in co-teaching these learner-centered units.

Figure 1

School Librarian Co-Teaching by Categories and Roles



Discussion

This paper contributes to the existing body of literature on librarian-teacher collaboration and instructional partnerships by presenting detailed ways in which co-teaching occurs between school librarians and classroom teachers to facilitate learner-centered instruction.

CO-TEACHING PROCESSES AND APPROACHES

In this study, school librarians and classroom teachers worked together throughout the co-teaching processes of planning, implementing, and assessing. The study concurs with the existing literature that suggests the importance of having a dedicated time for co-planning before the instruction occurs. Moreover, the educators collaboratively planned throughout the units, often informally, adapting to the changing and evolving nature of learners' inquiry and maker processes.

This study identified different ways school librarians facilitate learner-centered instruction while co-implementing instructional units, including leading instruction (such as offering mini-lessons), coaching individual students, and assisting with classroom management. Referring to the different methods of co-teaching suggested in the literature from the field of special education, the ways the educators in this study worked together can best be described as team co-teaching (Friend & Cook, 2010; Villa et al., 2013), in which educators share responsibilities and build on each other's individual strengths to plan, implement, and assess learning for all students. Other methods of co-teaching were also implemented, such as supportive co-teaching (also called one teaching, one assisting), in which one educator leads the instruction while the other rotates among the students to provide support and one-on-one assistance when needed, as well as parallel teaching, in which educators work with groups of students simultaneously but separately, lowering the teacher-student ratio (Friend & Cook, 2010; Villa et al., 2013).

School librarians and classroom teachers in this study also worked together to assess student work. In addition to the specific phase dedicated to evaluation in the Guided Inquiry Design (GID) framework, called Evaluate, librarians and teachers worked together on assessments from the initial planning stage, and librarians often participated in assessment throughout the units through informal check-ins and monitoring strategies.

CO-TEACHING MITIGATES CHALLENGES OF LEARNER-CENTERED INSTRUCTION IN SCHOOLS

While school librarians and teachers may co-teach in many different situations, this study was conducted in a learner-centered learning environment—specifically inquiry and maker units. The findings suggest librarian-teacher co-teaching greatly benefits the implementation of learner-centered instruction in schools.

Inquiry and maker learning are both types of learner-centered instruction, and they require personalized approaches to intervention. Modeled on Vygotsky's (1978) zone of proximal development (ZPD), Guided Inquiry Design (GID) suggests guidance must be developed around

the Zone of Intervention (ZOI), the "area in which a student can do with advice and assistance what he or she cannot do alone or can do only with great difficulty" (Kuhlthau et al., 2012, p. 20). ZPD and ZOI are not determined by age or grade level, however, so providing such personalized assistance is challenging in school settings with a high student-teacher ratio. In this study, several classroom teachers recognized the benefits of individual assistance to students, but they found checking in with each student to be a significant challenge. Co-teaching with librarians substantially mitigated this challenge. School librarians assisted teachers and students with these personalized processes by meeting different individual needs. The participating teachers viewed the school librarians' roles of working with individual students and assisting with classroom management as critical to the success of the learner-centered instruction in these highly individualized classrooms.

SCHOOL LIBRARIANS' USE OF COGNITIVE APPRENTICESHIP METHODS DURING CO-TEACHING

We found that many of the effective instructional methods that the school librarians used in this study were theoretically grounded in cognitive apprenticeship. Apprenticeship is a social learning method in which a more experienced person (an expert) assists a less experienced one (a novice), by providing structure and examples to support the attainment of goals. Cognitive apprenticeship is a social constructivist learning theory in which learning occurs through social interactions, using an apprenticeship model to support learning in a cognitive domain (Dennen, 2004). In the context of "learning-through-guided-experience," there are multiple methods of cognitive apprenticeship, such as scaffolding, modeling, mentoring, and coaching (Collins et al., 2004). School librarians' use of cognitive apprenticeship methods as a co-teaching strategy did not appear in previous literature, but a couple of existing pieces of literature suggested cognitive apprenticeship for school librarians to promote information and communications technology literacy (Tilley & Callison, 2007) or information literacy (Moore & Page, 2013).

In this study, one of the most crucial roles that school librarians played for the success of inquiry and maker learning was individual coaching and scaffolding. Scaffolding is a metaphor for a structure that is placed to help learners achieve their goals and is gradually removed until it is no longer needed (Vygotsky, 1978). Over the course of the units, librarians worked closely with individual students to help them frame appropriate inquiry questions, come up with project ideas, locate reliable information sources, choose suitable tools for their projects, and create and share final products that best demonstrated their learning and answered their inquiry questions. In addition to the one-on-one conferencing, school librarians attempted to identify the students who were struggling and the right moments that would provide the most benefit for the individuals. School librarians' affirmation and assistance for individuals right before they failed or changed their project out of frustration helped the learners develop the perseverance and grit they needed to finish the project. In these ways, school librarians supported students emotionally as well, working to alleviate anxiety and frustration, encouraging persistence, modeling resilience, and celebrating successes.

The study also found that the school librarians took part in modeling, "a form of demonstration followed by imitation" (Dennen, 2004, p. 816). Research shows that people often learn more efficiently through modeling than trial and error (Bandura, 1977). The examples presented in the

findings section show how one librarian modeled problem-solving and decision-making when encountering technology difficulties or information-seeking problems.

In addition to supporting students through cognitive apprenticeship methods, findings showed that the school librarians also mentored and scaffolded for other teachers. Fading is a key concept in scaffolding, referring to lessening assistance and gradually ceasing to scaffold as a learner gains independence, takes responsibility, and no longer needs much support. Fading was particularly noticeable in this study when librarians supported teachers with inquiry and maker learning over time. Teachers with less familiarity with inquiry or maker learning heavily relied on librarians initially, and as they gained experience in these areas, they needed the librarians less and less. The teachers' growth allowed the librarians more time to work with other teachers. Scaffolding and fading are not only desirable approaches to helping teachers gain familiarity and expertise in inquiry and maker learning, but also necessary processes when one or two school librarians have the duty of serving an entire school community.

IMPLICATIONS

This study offers implications for school librarians, classroom teachers, school administrators, and LIS (library and information science) educators teaching pre-service school librarians, as well as for future research areas. School librarians are encouraged to develop their expertise in the areas of inquiry processes, maker learning and technologies, and various instructional methods, including co-teaching and cognitive apprenticeship approaches. Co-teaching with classroom teachers requires school librarians to be flexible and adaptable to the evolving co-teaching relationships, adjusting to the teachers' experience levels and changing needs. A librarian can scaffold teachers' ability to facilitate learner-centered instruction and gradually fade as teachers gain independence and rely less on the librarian. Frequently, a single librarian serves the entire school community. Librarians can work with classroom teachers to develop and implement the monitoring strategies described in this study (e.g., monitoring student progress online and informal check-ins) when librarians cannot be physically present in the classroom due to conflicting schedules and other duties. School librarians should strive to advocate widely for the ways co-teaching can benefit everyone in the school community.

Classroom teachers are highly encouraged to seek and be open to opportunities to co-teach with school librarians. To promote students' 21st-century skills, such as collaboration, creativity, problem-solving, and critical thinking skills, teachers should aspire to use various learner-centered approaches beyond the traditional, lecture-based instruction. Implementing personalized learning, however, is challenging in the school environment. Therefore, teachers should team up with school librarians or other educators to offer creative learning experiences to students.

School administrators' support is crucial to making co-teaching happen. Administrators must cultivate a culture of instructional collaboration. Administrators play a critical role in mitigating the commonly reported barriers to collaboration in schools, such as lack of: time, professional development, and trusting environments. Administrators should encourage teachers to co-teach, provide professional development opportunities that bring librarians and teachers together, and give time for co-planning.

Ideally, pre-service teachers and school librarians would have opportunities to learn together during their pre-service training in higher education. Pre-service school librarianship education must teach different types of teaching and learning, including cognitive apprenticeship methods, such as coaching, mentoring, and scaffolding, and co-teaching strategies. Pre-service education should promote school librarians' technology proficiency, especially instilling the mindset of willingness to learn new technologies, and knowledge and skills on how to incorporate technology for learning.

More research is needed to advance our knowledge on librarian-teacher co-teaching and to illuminate ways to enable effective co-teaching practices in real-world settings. This research was conducted in one school district. Further research in different contexts will help to develop deeper knowledge on this topic. While this study was undertaken to understand the perspectives of educators, future research may investigate student experiences and perspectives in classes co-taught by librarians and teachers.

LIMITATIONS

This paper focused on co-teaching between classroom teachers and school librarians, and we did not analyze the role of specialized teachers, such as gifted-resource teachers. The credibility of this qualitative research could have been enhanced with a member check, in which participants review the findings to check their accuracy. The findings from this study, which include unique cases from one public school system, cannot be generalized.

Conclusion

This study shows that co-teaching between school librarians and classroom teachers as interdependent partners is highly beneficial for successfully implementing learner-centered, constructivist, and creative instructional approaches. In these personalized learning environments, school librarians can play critical roles in guiding and supporting both teachers and students, academically and emotionally. This research shows that school librarians who are equipped with strong knowledge and skills relating to learning processes and pedagogy (i.e., how to learn and how to facilitate learner-driven instruction), and technological proficiency are instrumental to the incorporation of inquiry and maker mindsets and processes into the school environment.

References

American Association of School Librarians. (2007). Standards for the 21st-century learner.

American Association of School Librarians. (2009). Empowering learners: Guidelines for school library programs.

American Association of School Librarians. (2018). National school library standards for learners, school librarians, and school libraries. American Library Association.

American Association of School Librarians, & Association for Educational Communications and Technology. (1998). Information power: Building partnerships for learning. American Library Association.

Bandura, A. (1977). Social learning theory. Prentice-Hall.

Bauwens, J., Hourcade, J. J., & Friend, M. (1989). Cooperative teaching: A model for general and special education integration. Remedial and Special Education, 10(2), 17–22. https://doi.org/10.1177/074193258901000205

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. The Journal of the Learning Sciences, 2(2), 141–178. https://doi.org/10.1207/s15327809jls0202_2

Brown, A. L., & Campione, J. C. (1996). Psychological theory and the design of innovative learning environments: On procedures, principles, and systems. In L. Schauble & R. Glaser (Eds.), Innovations in learning: New environments for education (pp. 289–325). Lawrence Erlbaum Associates.

Clapp, E. P., Ross, J., Ryan, J. O., & Tishman, S. (2017). Maker-centered learning: Empowering young people to shape their worlds. Jossey-Bass.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. Educational Researcher, 32(1), 9–13. https://doi.org/10.3102/0013189X032001009

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. The Journal of the Learning Sciences, 13(1), 15–42. https://doi.org/10.1207/s15327809jls1301_2

Dennen, V. P. (2004). Cognitive apprenticeship in educational practice: Research on scaffolding, modeling, mentoring, and coaching as instructional strategies. In D. H. Jonassen (Ed.), Handbook of research on educational communications and technology (pp. 813–828). Lawrence Erlbaum Associates Publishers.

Friend, M. P., & Cook, L. (2010). Interactions: Collaboration skills for school professionals (6th ed.). Pearson.

Friend, M., Reising, M., & Cook, L. (1993). Co-Teaching: An overview of the past, a glimpse at the present, and considerations for the future. Preventing School Failure: Alternative

Education for Children and Youth, 37(4), 6–10. https://doi.org/10.1080/1045988X.1993.9944611

Halverson, E. R., Lankind, A., & Willett, R. (2017). The Bubbler as systemwide makerspace: A design case of how making became a core service of the public libraries. International Journal of Designs for Learning, 8(1), 57–68. https://doi.org/10.14434/ijdl.v8i1.22653

Halverson, E. R., & Sheridan, K. (2014). The maker movement in education. Harvard Educational Review, 84(4), 495–504. https://doi.org/10.17763/haer.84.4.34j1g68140382063

Hang, Q., & Rabren, K. (2009). An examination of co-teaching: Perspectives and efficacy indicators. Remedial and Special Education, 30(5), 259–268. https://doi.org/10.1177/0741932508321018

Harada, V. H. (2016). A practice-centered approach to professional development: Teacher-librarian collaboration in Capstone projects. School Library Research, 19, 1–47. http://www.ala.org/aasl/slr/volume19/harada

Hsieh, H.-F., & Shannon S. E. (2005). Three approaches to qualitative content analysis. Qualitative Health Research, 15(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Hughes, H. (2014). School libraries, teacher-librarians and student outcomes: Presenting and using the evidence. School Libraries Worldwide, 20(1), 29–50. https://doi.org/10.29173/slw6869

Koh, K., Snead, J. T., & Lu, K. (2019). The processes of maker learning and information behavior in a technology-rich high school class. Journal of the Association for Information Science and Technology, 70(12), 1395–1412. https://doi.org/10.1002/asi.24197

Kuhlthau, C. C. (2004). Seeking meaning: A process approach to library and information services. Libraries Unlimited.

Kuhlthau, C. C., Maniotes, L. K., & Caspari, A. K. (2012). Guided inquiry design: A framework for inquiry in your school. Libraries Unlimited.

Kuhlthau, C. C., Maniotes, L. K., & Caspari, A. K. (2015). Guided inquiry: Learning in the 21st century (2nd ed.). Libraries Unlimited.

Latham, D., Gross, M., & Witte, S. (2013). Preparing teachers and librarians to collaborate to teach 21st century skills: Views of LIS and education faculty. School Library Research, 16, 1–23. http://www.ala.org/aasl/slr/volume16/latham-gross-witte

Latham, D., Julien, H., Gross, M., & Witte, S. (2016). The role of inter-professional collaboration to support science learning: An exploratory study of the perceptions and experiences of science teachers, public librarians, and school librarians. Library & Information Science Research, 38(3), 193–201. https://doi.org/10.1016/j.lisr.2016.08.002

Loertscher, D. V. (2014). Collaboration and coteaching: A new measure of impact. Teacher Librarian, 42(2), 8–19.

Loertscher, D. V., & Koechlin, C. (2015). Coteaching and the learning commons. Teacher Librarian, 43(2), 12–16.

Loertscher, D. V., Preddy, L., & Derry, B. (2013). Makerspaces in the school library learning commons and the uTEC Maker Model. Teacher Librarian, 41(2), 48–51.

Loertscher, D. V., & Zepnik, J. (2019). Coteaching revisited: The replication study. Teacher Librarian, 47(1), 40–47.

Maker Education Initiative. (2018). Resources. Maker Ed. Retrieved from https://resources.makered.org/

McKenney, S., & Reeves, T. (2019). Conducting educational design research (2nd ed.). Routledge.

Medaille, A., & Shannon, A. W. (2012). Co-Teaching relationships among librarians and other information professionals. Collaborative Librarianship, 4(4), 132–148. https://doi.org/10.29087/2012.4.4.04

Montiel-Overall, P. (2005). Toward a theory of collaboration for teachers and librarians. School Library Media Research, 8, 1–31. http://www.ala.org/aasl/sites/ala.org.aasl/files/content/aaslpubsandjournals/slr/vol8/SLMR_TheoryofCollaboration_V8.pdf

Montiel-Overall, P. (2008). Teacher and librarian collaboration: A qualitative study. Library & Information Science Research, 30(2), 145–155. https://doi.org/10.1016/j.lisr.2007.06.008

Moore, P., & Page, N. (2013). Cognitive apprenticeships in education for information literacy. In P. L. Ward (Ed.), Continuing professional education for the information society: The fifth world conference on continuing professional education for the library and information science professions (IFLA Publication 100, pp. 80–93). K. G. Saur.

Moorefield-Lang, H. (Ed.). (2018). School library makerspaces in action. Libraries Unlimited.

Moreillon, J. (2013). Educating for school library leadership: Developing the instructional partnership role. Journal of Education for Library & Information Science, 54(1), 55–66.

Moreillon, J., & Ballard, S. D. (2012). Coteaching: A pathway to leadership. Knowledge Quest, 40(4), 6–9.

Moreillon, J., Kimmel, S., & Gavigan, K. (2014). Educating pre-service school librarians for the instructional partner role: An exploration into university curricula. School Library Research, 17, 1–25. https://www.ala.org/aasl/sites/ala.org.aasl/files/content/aaslpubsandjournals/slr/vol17/SLR_EducatingPreservice_V17.pdf

Murawski, W. W., & Swanson, H. L. (2001). A meta-analysis of co-teaching research: Where are the data? Remedial and Special Education, 22(5), 258–267. https://doi.org/10.1177/074193250102200501

Peppler, K., Halverson, E. R., & Kafai, Y. B. (Eds.) (2016a). Makeology: Makers as learners (Vol. 2). Routledge.

Peppler, K., Halverson, E. R., & Kafai, Y. B. (Eds.) (2016b). Makeology: Makerspaces as learning environments (Vol. 1). Routledge.

Phillips, A. L., & Lee, V. R. (2019). Whose responsibility is it? A statewide survey of school librarians on responsibilities and resources for teaching digital citizenship. School Library Research, 22, 1–20. http://www.ala.org/aasl/slr/volume22/phillips-lee

Phillips, A. L., Recker, M., & Lee, V. (2019). How librarians enact innovative activities: A framework for characterizing 21st century school librarianship. School Libraries Worldwide, 25(1), 21–34.

Rawson, C. H. (2014). Every flower in the garden: Collaboration between school librarians and science teachers. School Libraries Worldwide, 20(1), 20–28.

Rice, D., & Zigmond, N. (2000). Co-Teaching in secondary schools: Teacher reports of developments in Australian and American classrooms. Learning Disabilities Research & Practice, 15(4), 190–197. doi:10.1207/SLDRP1504_3

Roth, W.-M., & Tobin, K. (2004). Coteaching: From praxis to theory. Teachers and Teaching, 10(2), 161–179. https://doi.org/10.1080/0954025032000188017

Scruggs, T. E., Mastropieri, M. A., & McDuffie, K. A. (2007). Co-Teaching in inclusive classrooms: A metasynthesis of qualitative research. Exceptional Children, 73(4), 392–416. https://doi.org/10.1177/001440290707300401

Tilley, C. L., & Callison, D. (2007). New mentors for new media: Harnessing the instructional potential of cognitive apprenticeships. Knowledge Quest, 35(5), 26–31.

Tobin, K. 2006. Learning to teach through coteaching and cogenerative dialogue. Teaching Education, 17(2), 133–142. https://doi.org/10.1080/10476210600680358

Todd, R. (2008). Collaboration: From myth to reality: Let's get down to business. Just do it! School Library Media Activities Monthly, 24(7), 54–58.

Villa, R. A., Thousand, J. S., & Nevin, A. (2013). A guide to co-teaching: New lessons and strategies to facilitate student learning. Corwin Press.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

Zhang, Y., & Wildemuth B. M. (2017). Qualitative analysis of content. In B. M. Wildemuth (Ed.), Applications of social research methods to questions in information and library science (2nd ed., pp. 318–329). Libraries Unlimited.

Appendix A: Major Interview Questions

*Notes: The findings reported in this paper focus on co-teaching between school librarians and classroom teachers, not findings on all of the interview questions below.

- Demographic information
- What worked well when you facilitate GID or GIDM units?
- What did not work well? What were some of the challenges you experienced as a teacher/librarian? What do you wish you had done differently?
- What were some of the challenges that students experienced? What did you do, or what do you think you could do in the future? In other words, what are the areas that educators need to help with or intervene in?
- What were the strengths students brought in to the inquiry and maker learning? Anything you're impressed with about your students?
- How did applying the inquiry or maker approach to the standard-based curriculum work? Do you feel like the standards were met/addressed?
- What did you hope students learn in this unit? Do you feel that students are learning the content knowledge with this approach?
- What do you think the benefit of using GID or Maker approach?
- What do you think the challenges of using GID or Maker approach?
- Did your students work independently or collaboratively? How/Why?
- Tell us about how you worked with librarians (or classroom teachers) to design and implement the GID or GID+Making units.
- Have you talked about this unit with parents/other teachers/administrators? Did you receive any feedback, concern, or compliments?
- What you do think you need to facilitate GID/Maker units successfully?
- [Librarians only] What were your roles as school librarians in the unit?
- [Librarians only] Do you see any difference this semester from previous semesters? If so, what are they and why do you think so?
- [Librarians only] What kind of changes did you make from last semester (if any)?
- [Librarians only] Tell us about how you worked with students about information search, use, and evaluation. What kinds of information literacy instructions did you offer-either formally or informally, and either individually or to the whole class?
- [Librarians only] Tell us about what you saw from the students in the Explore and Gather phases, as well as their experience with Inquiry Log.

Appendix B: Field Observation Template

Semester/Year:

School:

Unit Name/GID or GIDM:

Teacher:

Observer:

Date of Observation/GID phases:

Description of Activities:

Reflection:

Emerging Questions and Analyses:

Moving Forward:

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