

2014

# Are We Leaving Them Lost in the Woods with No Breadcrumbs to Follow? Assessing Signage Systems in School Libraries

Lauren H. Mandel

*University of Rhode Island*, [lauren\\_mandel@uri.edu](mailto:lauren_mandel@uri.edu)

Melissa P. Johnston

Follow this and additional works at: [https://digitalcommons.uri.edu/lsc\\_facpubs](https://digitalcommons.uri.edu/lsc_facpubs)

**The University of Rhode Island Faculty have made this article openly available.  
Please let us know how Open Access to this research benefits you.**

This is a pre-publication author manuscript of the final, published article.

Terms of Use

This article is made available under the terms and conditions applicable towards Open Access Policy Articles, as set forth in our [Terms of Use](#).

## Citation/Publisher Attribution

Mandel, Lauren H., and Melissa P. Johnston. "Are we leaving them lost in the woods with no breadcrumbs to follow? Assessing signage systems in school libraries." *School Libraries Worldwide*, vol. 20, no. 2, 2014, pp. 38-53.

This Article is brought to you for free and open access by the Graduate School of Library and Information Studies at DigitalCommons@URI. It has been accepted for inclusion in Graduate School of Library and Information Studies Faculty Publications by an authorized administrator of DigitalCommons@URI. For more information, please contact [digitalcommons@etal.uri.edu](mailto:digitalcommons@etal.uri.edu).

# **Are We Leaving Them Lost in the Woods with No Breadcrumbs to Follow? Assessing Signage Systems in School Libraries**

**Lauren H. Mandel, PhD**  
**University of Rhode Island**

**Melissa P. Johnston, PhD**  
**University of Alabama**

*Preprint*

## **Abstract**

In order to successfully navigate space in seeking information, students need to develop their spatial thinking, or the ability to visualize and interpret location, distance, direction, relationships, movement, and change through space. Learning to think spatially has been defined as a vital skill for students to be equipped properly for their future (National Research Council, 2006; National Science Foundation, 2010). Wayfinding refers to the ability of users of the built environment (i.e., a facility) to navigate through that environment to find specific destinations (Mandel, 2010). In the school library environment this means that student users can find and access the information they need for school related tasks and assignments. Developing wayfinding skills contributes to the development of spatial literacy. Often, the school provides a child's first experience independently navigating spaces, yet there is limited research on assessing the usability and navigability of school library spaces. The purpose of this study is to explore how to improve the effectiveness of wayfinding and spatial awareness tools in a school library environment addressing the research question: How effective are the existing wayfinding aids in communicating spatial information to the user? This report is the results of the pilot study focused on an expert review of the signage systems in a selection of school libraries.

## **Introduction**

The school library is an important element in supporting the learning process. It plays a key role as a place for access to information, knowledge building, and problem solving. The nature and quality of the environment in the school library also influence how and what young students learn. A good school library is characterized by well-designed, sufficient, and flexible space, is equipped with an appropriate collection to support curriculum goals, has a design that is based on consideration of the unique and diverse

needs of the learners it serves, and utilizes a good management system to ensure optimum utilization by the school learning community (American Association of School Librarians (AASL), 2009; Everhart, 1998). The school library should be a place where children can find things easily and learn to be independent library users (Johnston & Bishop, 2011). This requires that the school library be designed so that students are directed to the materials they need and can navigate easily and independently – especially as students are learning library organization and how to find information they need for learning and pleasure.

Wayfinding refers to the ability of users of the built environment (i.e., a facility) to navigate through that environment to find specific destinations (Mandel, 2010). In the school library environment this means that student users can find and access the information they need for school related tasks and assignments. Developing wayfinding skills and habits contributes to the development of spatial literacy, a cognitive skill that can be used in everyday life, the workplace, and science to structure problems, find answers, and express solutions using the properties of space. People solve various wayfinding tasks such as search, exploration, route following, or route planning in contexts including outdoor and indoor spaces, and virtual reality simulations (National Research Council, 2006). The cognitive resources required for these tasks differ in the respects of the format and content of spatial knowledge involved and with the strategies of problem solving, such as the use of perceptual cues from the environment, including signage.

### **Research Purpose**

Recently much concern and research in the area of school libraries has focused on the young learner's ability to successfully navigate online digital resources and virtual worlds, but the school library as a physical space has been largely ignored. This research

asserts that the school library as a learning space where students can successfully navigate and feel a sense of familiarity is still a vital and necessary element in the 21<sup>st</sup> century world of information. While students alternate between physical and digital spaces, the physical environment must still be considered as students continue to live in a physical world that they must be able to successfully navigate to find the information they need to solve school- and life-related problems.

Often, the school provides a child's first experience with independently navigating spaces, yet there is limited research on assessing the usability and navigability of school library spaces (Mandel & Johnston, 2013). Signage is an important wayfinding aid strategy for all libraries (Stempler & Polger, 2013), but is all the more important in the school library which needs to support students who are still learning about the organizational scheme of the library and developing spatial thinking skills (Read, 2003). In order to successfully navigate space while seeking information, students need to develop their spatial thinking, or the ability to visualize and interpret location, distance, direction, relationships, movement, and change through space. Finding one's way is a requirement of daily life and "purposeful navigation between places is perhaps the most prominent real-world application of spatial cognition" (Wiener, Büchner, & Hölscher, 2009, p. 152). Wayfinding is not only getting to a location successfully, but also developing an awareness of the environment that contributes to more efficient planning and execution. Wayfinding has the potential of improving a person's spatial skills or spatial literacy and the design of wayfinding systems and aids, such as signage, when associated with completing a task or solving a problem, can create this spatial awareness (Li & Kippel, 2012). Yet, when not given adequate directional cues, disorientation will hinder both wayfinding performance

and spatial knowledge acquisition. The use of signage is an important strategy that can be utilized to improve children's wayfinding and therefore develop spatial orientation abilities in their environment (Helvacioğlu & Olgunturk 2011; Read, 2003).

This report is the result of the pilot study focused on an expert review of the signage systems in a selection of school libraries. The goal of the pilot study is to build the foundation and establish a reliable method for a full study that will explore the contribution of signage to children's ability to complete wayfinding tasks in school libraries. The overarching purpose of this research is to explore how to improve the efficiency of wayfinding in order to contribute to developing spatial awareness in a school library environment addressing the research question: How effective are the existing wayfinding aids in communicating spatial information to the user?

### **Related Literature**

The school library must be designed so that students are directed to find information they need for learning and pleasure and can navigate the facility easily and independently, especially as students are learning library organization. In order to successfully navigate space in seeking information, students need to develop wayfinding skills and habits in order to contribute to their development of spatial literacy. Improving access to learning resources through provision of directional text-based and graphics-based signage that define different sections of the library can be a useful strategy to facilitate wayfinding in a school library. There is very little research that examines wayfinding strategies in the school library environment, therefore the areas of education, public libraries, and academic libraries were drawn upon.

### **Spatial Literacy**

People undertake a range of daily activities that are characterized by spatial thinking with one of the main examples being planning and navigating a route from an origin to a destination. Navigation is an extremely common task yet one that requires complex cognitive processing to find one's way in an environment (Jansen-Osmann & Wiedenbauer, 2004; Li & Klippel, 2012). Learning to think spatially is a form of learning how to learn and has been defined as a vital skill for students to be equipped properly for their future (National Council of Research, 2006; National Science Foundation, 2010). Without spatial knowledge, people may get lost or feel disoriented, frustrating experiences for people who are trying to reach a specific destination (Arthur & Passini, 1992; Cubukcu & Nasar, 2005; Li & Klippel, 2012). In the case of students seeking information this can result in helplessness, confusion, disorientation, and frustration, all of which can lead to students simply giving up on their information seeking tasks (Eaton, 1991a, 1991b). This is related to the idea of cognitive mapping, a process of creating a mental map that every human being uses to find his or her way in any environment (Cornell, Heath, & Alberts, 1994; Eaton 1991a; Hardwick, McIntyre, & Pick, 1976; Pollet & Haskell, 1979). These "representations act as the basis for everyday spatial behavior" (Pollet & Haskell, 1979, p. 21) and signage, as an important element of the library environment, contributes to these cognitive maps. Eaton conducted multiple studies focusing on wayfinding, spatial cognition, and signage in libraries, those specifically focused on children, finding that user search strategies that utilized wayfinding aids, such as well-placed signage, limited the amount of information users needed to process and therefore helped to reduce confusion and route uncertainty (Eaton, 1991a; 1991b; Eaton, Vocino, & Taylor, 1992).

Spatial literacy develops over a period of years, and this process begins in childhood (Helvacioğlu & Olgunturk, 2011; National Research Council, 2006; Read, 2003; Wilson, 1997). Children have the majority of their first experiences with spatial knowledge development in school and these experiences can affect children's psychology either positively or negatively. Children learn by interacting with their environments, and the nature and quality of the environment are influential on how and what young students learn. Places that provide positive experiences offer opportunities for children to explore, manipulate, and be involved (National Research Council, 2006; Read, 2003; Wilson, 1997). A disorganized environment suggests to children that they are not valued or respected. These kinds of messages affect children's perception of themselves as learners and explorers, self-esteem, and feelings of competence (Helvacioğlu & Olgunturk, 2011; Wilson 1997). Environments are characterized by affordances that have a very important role on children's perception and learning within that environment. Affordance means "the functional qualities of an environment that helps people meet important goals" (Gifford, 2002, p. 72). This may be anything that enables the environment to be used in a particular way by a particular group of people, and children require more support than adults in navigating an environment (Gifford, 2001; Helvacioğlu, 2007; National Research Council, 2006); signage provides such an affordance.

The National Research Council Committee on the Support for Thinking Spatially (2006) finds that spatial literacy is critical and that "without explicit attention to spatial thinking, we cannot meet our responsibility for equipping the next generation of students for life and work in the twenty-first century" (p. 10). School librarians have a vital role to play in developing students' twenty-first century skills, including spatial literacy, or the

way we navigate the world and manipulate the space around us, to ensure they are prepared to succeed and participate in today's society (AASL, 2009; National Research Council, 2006); therefore school librarians should be devising methods to develop spatial thinking in their students.

### **Wayfinding**

Wayfinding necessitates spatial knowledge that contains one's current location, intended destination, and the spatial relation between them. This type of spatial literacy, the ability to visualize and interpret location, distance, direction, relationships, movement, and change through space is fundamental to problem solving. Wayfinding is spatial problem solving where the goal is to reach a destination and includes three specific but interrelated processes. These processes are, "*decision making* and the development of a plan of action; *decision execution* that transforms the plan into appropriate behavior at the right space; *information processing* understood in its generic sense as comprising of environmental perception and cognition, which, in turn, are responsible for the information basis of the decision-related processes" (Arthur & Passini, 1992, p. 25). Wayfinding involves not only getting to a location successfully but also developing an awareness of the environment that contributes to more efficient planning and execution of future routes. With awareness comes an improvement of spatial literacy.

There are two types of wayfinding design strategies: architectural wayfinding design and informational wayfinding design (Helvacioğlu, 2007; Pollett & Haskell, 1979). These strategies help people construct their mental maps of the environment. Architectural wayfinding design deals with the layout of the space and landmarks that are used in the space. Informational wayfinding design deals with the building information system, that is

signage and orientation aids, like maps (Helvacioğlu, 2007; Pollett & Haskell, 1979).

Wayfinding strategies should communicate effectively to the broadest group possible, including people with a wide range of sensory, physical, language, and intellectual abilities; social and cultural backgrounds; age and gender differences (Arthur & Passini, 1992).

Minimal research has addressed library patron wayfinding (Hassanain & Mudhei, 2006; Li & Kippel, 2012; Mandel, 2010, 2012, 2013), and even less in the school library context (Eaton, 1991a, 1991b; Mandel & Johnston, 2013). There is some associated research on children's or teens' wayfinding that indicates there is concern about planning for children's wayfinding in a different context from adults' wayfinding. Cornell, Heath, and Rowat (1992) compared wayfinding of six year olds, 12 year olds, and 22 year olds. While the 12 and 22 year olds' wayfinding behaviors did not vary significantly, six year olds had the poorest wayfinding performance suggesting younger children need more and different kinds of wayfinding aids. Another study comparing the wayfinding abilities of eight year olds, 12 year olds, and 25 year olds found similar results (Cornell et al., 1994). In this study eight year olds were found to be less accurate in place recognition than 12 or 25 year olds, with the 12 and 25 year olds exhibiting similar levels of accuracy in place recognition. Jansen-Osmann and Wiedenbauer (2004) also found children's wayfinding performance levels to differ from adults, with children requiring more learning trials than adults to achieve the same level of wayfinding proficiency in the setting. Developing wayfinding skills and habits contributes to the development of spatial literacy and hence school librarians must consider the wayfinding practices of their users and devise strategies to facilitate access to resources and information, while helping students develop spatial literacy.

Wayfinding, like other information-seeking processes, is seen as a complex process. It combines the attributes of the given environment, the mechanics of the seeker's cognitive processes, and available tools to assist with the process. In order to facilitate the wayfinding process, one must determine the preferences of the information seekers in processing information and tools that will support them, as well as the environmental concerns (Eaton, 1991a, 1991b; Gifford, 2001; Mandel, 2012; O'Neill, 1991).

### **Signage**

Signs are wayfinding aids or markers that support navigation and are integral to the wayfinding process (Arthur & Passini, 1992). "One of the most common current forms of spatial written communication is signage" (Beecher, 2009, p. 22). Signs have three main purposes: directional signs orient users to the environment using arrows or directional language, such as "here" or "turn left;" regulatory signs explain rules and can be external regulations like emergency and fire signage or internal regulations about library-specific policies; and informational signs comprise all other signs, including advertisements, art, etc. In a school library setting directional signs might include arrows to specific sections of the library or a "Checkout Your Books Here" sign, regulatory signs might include "Library Rules," "No Talking in Cell Phones in the Library," or "Emergency Exit" signs, and then there are informational signs such as shelf labels that give call numbers of books on that shelf such as "300 - 400" or signs on the end of the shelves like "Biographies."

Yet, all too often, signage content conveys little or none of the required spatial information to the reader (Arthur & Passini, 1992). Larken-Lieffers (2001) found that inappropriate language in signage inhibited children's (and parents') use of juvenile nonfiction. In this case, inappropriate language means language that was not specific

enough, with signs saying “nonfiction” but not “juvenile.” Larkin-Lieffers specifically recommends the use of signage to draw patrons’ attention to specific materials. This might include directional signage that indicates physical directionality, rather than rules (regulatory signage) or other information (informational signage). Stempler and Polger (2013) identify the navigational value of signage and divide the signs in their audit of an academic library’s signage into the three main categories: directional, policy, and informational. Like Mandel (2012), they found directional signs to comprise the smallest group of signs in their library, 12% (Stempler & Polger, 2013).

Providing text-based and graphics-based signage can assist students with differing needs in accessing information. Improving access to learning resources through the use of signs is an important general strategy for all libraries, but is all the more important at the school library where students are still learning about the organizational scheme of the library. With younger students who are just beginning to be exposed to library organization systems and are not yet fluent readers, it is particularly helpful that shelf signs include not only text, but also graphics and pictures that represent subjects. The use of color and graphics in signage to aid wayfinding is a particularly important design element that can be utilized used to improve children’s wayfinding and spatial orientation abilities in their environment (Read, 2003).

Graphics are a form of engineered wayfinding tools; the most common are signage and maps. They are used to communicate general information, to give information about the setting or area, to establish orientation and current location, to indicate directions to destinations, or to identify destinations. There are a number of authors who have proposed that the solution to wayfinding problems in libraries is the installation of “proper” signage.

They address the style, placement, color, and size of signs (Brown, 2002; Eaton, 1991a, 1991b; Li & Klippel, 2012; Mandel, 2010, 2012, 2013; Pollet & Haskell, 1979). Eaton (1991a) studied the performance of students in locating items in a library. While she did mention that libraries should have “environmental assistance to user searches – in the form of legible buildings” and “clear and predictable shelving arrangements” (p. 85), her greatest emphasis was on the signage systems. Li and Klippel (2012) asserted orientation in an unknown environment is an important factor for successfully reaching a specified destination and usually requires external knowledge sources. People need to know where they actually are in complex unfamiliar environments to feel secure and safe, and the difficulty of navigating unfamiliar environments suggests the need to support users’ wayfinding.

Signs are major elements of information systems and can be used to enhance wayfinding effectiveness. However, faulty signs can cause wayfinding problems in unfamiliar environments. Location, content, and color of signs play important roles in representing beneficial and functional information systems. Location means that signs should be visible at transitional areas and at intersections; at every decision point a new sign is needed (Arthur & Passini, 1992; Eaton 1991a, 1991b; Li & Klippel, 2012). O’Neil (1991) found that “signage resulted in a 13% increase in the rate of travel, a 59% decrease in the wrong turns, and a 62% decrease in backtracking across the five settings” (p. 553).

The content of messages on signs should be considered because the remembrances of signs decrease when the number of contained words increases (Helvacioğlu, 2007; Helvacioğlu & Olgunturk, 2011; Pollett & Haskell, 1979). Design elements such as font type and color schemes must also be considered for contrast and readability (Helvacioğlu &

Olgunturk, 2011; Jansen-Osmann & Wiedenbauer, 2004; Read, 2003). Color is an important element to consider because it has a significant effect on children's wayfinding and spatial orientation abilities in school environments (Jansen-Osmann & Wiedenbauer, 2004; Read, 2003). Children need their environment to be interesting, and they make associations with color and shapes rather than form. Therefore, using color in signage can provide visual interest, supply information for efficient navigation, and improve children's wayfinding and spatial orientation abilities in their environment (Helvacioğlu & Olgunturk, 2011; Read, 2003), but color must be considered carefully to ensure there is sufficient contrast between the text and background to allow a sign to be legible (Arthur & Passini, 1992).

While research on user wayfinding in all library types is beginning to emerge, school library design manuals pay little attention to this topic and the supports that students need to successfully navigate the library in finding information, such as signage. In a handbook on designing school libraries for the future, the purpose of signage in school libraries is described as "to help users navigate and make it easier for them to find what they need; this removes psychological barriers and makes the library more inviting to the user" (Erikson & Markuson, 2007, p. 75). However, the focus is on aesthetics of signage and the overall signage system, not on directional signage that actually helps users navigate. And the overall focus in facilities planning guides is not about wayfinding, navigation, or signage. Signage is only covered on one or two pages of manuals by Baule (2007), Erikson and Markuson (2007), and Hart (2006). The few recommendations include suggestions such as using color-coding to designate areas of the library and ensuring ADA (Americans with Disabilities Act) compliance (Erikson & Markuson, 2007). School library designers are,

however, cautioned to use high contrast between the text and background of signs (Baule, 2007), supporting Arthur and Passini's work (1992).

## **Conclusion**

The difficulty of navigating built environments suggests the need to support wayfinding by using appropriate supports or affordances, such as signage, to improve the effectiveness of wayfinding and the development of spatial knowledge. The school library should be an equitable access point for rich and diverse resources that provides intellectual and physical access to information in all formats, at all levels, and to all members of the learning community (AASL, 2009). While the physical location of the library may not be ideal for supporting maximum access to learning resources, accommodations and changes can be made that will benefit the school library's student users. Improving access to learning resources through provision of directional text-based and graphics-based signage in defining different sections of the library can be a useful wayfinding strategy to help various learners locate and access the information they need, but the lack of empirical research into wayfinding in school libraries is a research gap that needs to be addressed.

## **Method**

The pilot study focused on the wayfinding strategy of signage systems in order to explore the contribution of supports or aids that school libraries are utilizing in order to answer the research question: How effective are the existing wayfinding aids in communicating spatial information to the user? The overarching purpose of this research is to explore how to improve the efficiency of wayfinding and spatial awareness in a school library environment. This paper reports on the pilot study portion of a larger study.

This research utilized an expert review approach, in which two experts reviewed all signage in a sample of school libraries, noting elements such as signage type, location, and errors. The two researchers contributed expertise in the area of school libraries, 21<sup>st</sup> century literacies, and wayfinding based on their previous research in these areas and from practice as librarians. For purposes of the pilot study, the researchers deemed it appropriate to utilize a purposive sample of schools (Babbie, 2012). One of the researchers had access to and contacts in the chosen community and was given the names of several schools that would be accessible during the time period in which the researchers planned to conduct the study. The research was conducted in a suburban area in the southern United States, using an elementary, middle, and high school library in a suburban school district. In the U.S., elementary school generally refers to kindergarten through 5th grade (5-10 year olds), middle school to grades 6-8 (11-13 year olds), and high school to grades 9-12 (14-18 year olds). The two researchers served as the expert reviewers of the school libraries' signage. One researcher is an expert in school libraries and the other is an expert in wayfinding, so the two were able to work with each other to develop an appropriate assessment of signage in school libraries. The researchers conducted the assessments in May 2013, visiting each of the schools during the same week to conduct the expert review.

In order to determine the effectiveness of the signs in communicating spatial information to the user, the researchers conducted a review of all the signage in each library. Only signs in the physical library room were assessed; this did not include adjacent rooms such as offices, teacher workrooms, or storage rooms. Signs in the libraries meant more for teachers and staff, such as copyright signage by copy machines, were assessed in the context of their effectiveness in assisting those users (i.e., is this sign effective in

guiding teacher and staff users' wayfinding?). In the case of this research effectiveness of the signage refers to whether the signs communicate accurately and clearly and this is operationalized based on previous research (Arthur & Passini, 1991; Eaton, 1991a, 199b; Eaton, Vocino, & Taylor, 1992): the location and physical placement of the sign – is the sign placed appropriately in relation to the information it is communicating and at the proper height for student users; the clarity of the sign – does the sign communicate clearly the spatial information the user needs utilizing legible text in language appropriate for the student users, appropriate color(s) that provide enough contrast to be readable (e.g., black text is readable on a white background but less so on a dark gray background), not problematic for people with colorblindness, and not misleading, and/or graphic(s) that are understandable and make sense in the context of the sign; and the currency of the sign – does the sign communicate current information to the user.

The researchers adapted a signage coding instrument used in a prior study in a public library (Mandel, 2012). Adaptations included changing the category “appropriate language,” used in a library serving bilingual patrons, to the category “appropriate grade level language” for school libraries (See Appendix A). During the school site visits, the experts independently reviewed all signage in each school library, taking photographs of exemplar signs that illustrated good use of signage to guide children’s wayfinding and others that illustrated issues, such as misinformation, poor use of color, etc. Reviewing all the signage in the library is necessary for an effective signage audit (Stempler & Polger, 2013).

Inter-coder reliability testing occurred after data collection was complete. First, the researchers discussed the discrepancy in the total number of signs each had coded,

engaging in negotiation and ultimately agreeing to use the total generated by the reviewer with more experience with the method (n=432). To calculate inter-coder reliability, the researchers decided to utilize percent agreement as this is a pilot study and that is an acceptable measure. Percent agreement is calculated by totaling the number of agreements and dividing that by the total number of times a decision was made by the coders (Neuendorf, 2002). This was done for a sample of 10% of the total coded signs, with overall percent agreement on all analyses of the sample signs equaling 82.6%, which is acceptable for a pilot study. After ascertaining an acceptable level of reliability had been achieved, the researchers utilized descriptive statistics to compare the total signs in various categories and identify specific areas of focus for further study.

This research is limited in that it is a pilot study and relies on a small, purposive sample of school libraries. As the findings are not meant to be generalized, but are meant to provide a starting point for a larger, more comprehensive study, this limitation is acceptable to the purposes of the pilot study. It is offset by the potential implications of the research for the design, evaluation, and improvement of wayfinding systems in school libraries such that learners are more easily able to locate and utilize library materials to solve their information problems and gain spatial awareness.

## **Results**

The expert signage review identified 435 signs in all three libraries (n=203 for the elementary school, n=93 for the middle school, and n=139 for the high school). The vast majority of signs were informational (n=361; 83.0%) versus regulatory (n=64; 14.7%) and directional (n=10; 2.3%). All but three signs were assessed as age appropriate (n=432; 99.3%). Eight issues were identified (See Figure 1), six of which had been identified in the

prior study using the assessment instrument (Mandel, 2012): unclear signs, signs in the wrong location, outdated signs, damage to signs, damage to sign holders, and other. One of the most noted issues was that signs were unclear, which designated signs that were hard to read for a variety of reasons, including sign too small for amount of text, text too small to be legible from the distance, and signs that were too high to read, or signs that did not make sense such as signs that used alternate names for the library, etc. The two new issues identified in this study are poor placement of signs and poor use of color. Wrong location refers to signs that identify a particular section but are located in a different section, an issue also found in Li and Klippel's study of wayfinding in an academic library (2013), whereas placement issues refer to signs in locations that make them hard to see or read, such as pushed back on high shelves or at odd angles. Poor use of color refers to misuse of colors with cultural significance and to use of colors that do not provide sufficient contrast with the background of the sign to render the sign legible.

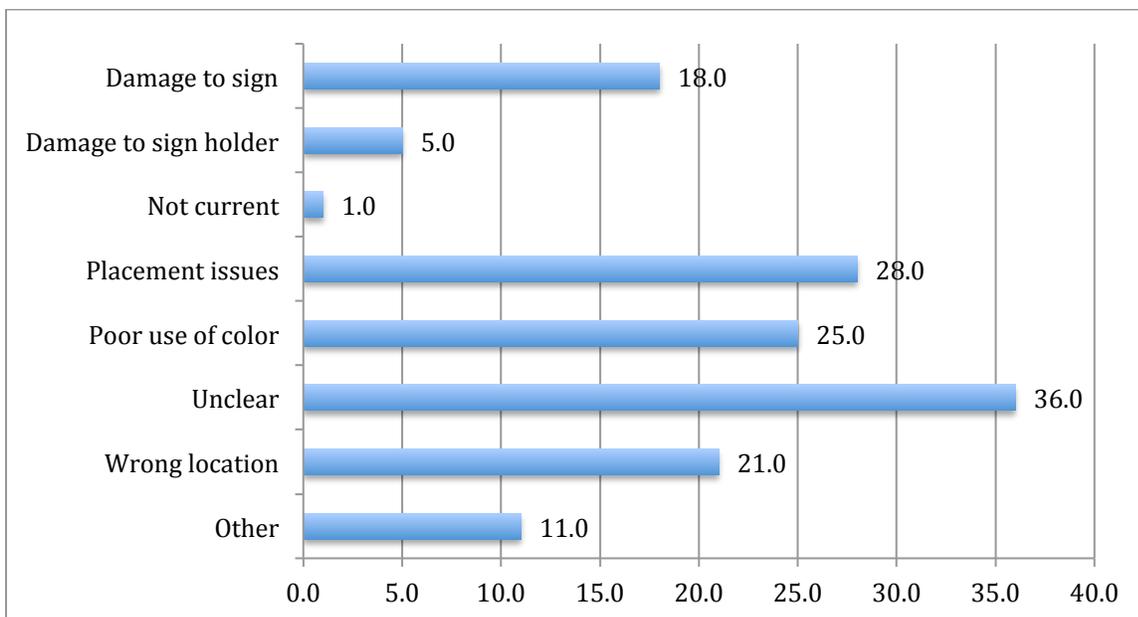


Figure 1. Total Signs with Issues by Issue

		Elementary school		Middle school		High school		Total	
		%	n	%	n	%	n	%	n
total signs by issue	Other	0.0%	0.0	11.8%	11.0	0.0%	0.0	2.5%	11.0
	Wrong location	7.9%	16.0	4.3%	4.0	0.7%	1.0	4.8%	21.0
	Unclear	7.9%	16.0	15.1%	14.0	4.3%	6.0	8.3%	36.0
	Poor use of color	11.3%	23.0	2.2%	2.0	0.0%	0.0	5.7%	25.0
	Placement issues	3.4%	7.0	14.0%	13.0	5.8%	8.0	6.4%	28.0
	Not current	0.0%	0.0	0.0%	0.0	0.7%	1.0	0.2%	1.0
	Damage to sign holder	2.5%	5.0	0.0%	0.0	0.0%	0.0	1.1%	5.0
	Damage to sign	5.9%	12.0	6.5%	6.0	0.0%	0.0	4.1%	18.0

## Findings & Discussion

Several key findings emerged from the pilot study. First, despite the researchers' assumption at the outset of the research that age appropriateness would be a significant issue, the findings show there are not many issues with age appropriateness of signage in the sample school libraries. Second, while use of color in signage was not an issue in the public library (Mandel, 2012), color usage was a fairly large issue in the sample school libraries. Third, as was found in a public library study (Mandel, 2012) and in an academic library (Stempler & Polger 2013) study, there was a severe lack of directional signage in the sample school libraries. Finally, the most noted issues were found to be with unclear signs and signage placement.

The previous study in public libraries had considered language appropriateness of signage in a library serving a bilingual community (Mandel, 2012). For this study, language appropriateness was modified to age appropriateness. Based on the school library expert's experience in school libraries, the researchers presumed there would be a fairly large number of age inappropriate signs in the sample school libraries. In reality, 1.0% of signs in the elementary school library, 1.1% in the middle school library, and 0.0% in the high school library were age inappropriate. Instead, there were many good examples of age appropriate signage in the school libraries, such as a sign using text speak in the high school library, which would appeal to teens, and signs utilizing characters from children's book series in the elementary school library. It is important to consider the needs of the user when considering language used in signage. Not only is reading level appropriate language necessary, but also language the users can relate to rather than library terminology (Dempsey, 2006; Eaton, 1991a; Eaton, 1991b; Larkin-Lieffers, 2001).

Additionally, if the user population of the school includes special populations such as English as a second language learners or learners with disabilities, then signage in other languages may be necessary as well (Brown, 2002; Larkin-Lieffers, 2001; Mandel, 2012).

Color-coding and color usage are more prevalent in school libraries than public libraries. Color is a useful design element for spatial orientation and space definition for creating environmental information that supports children's wayfinding abilities including helping children orient themselves in a new environment (Jansen-Osmann & Wiedenbauer, 2004), especially for younger children who may have limited reading skills. In the elementary school library, the librarian had the four segments of the library strictly color-coded with all subject heading and Dewey Decimal signage in each section appearing in the designated color. This was a good use of color to create a system. The use of color in signage is an important aspect of wayfinding. The use of color can create visual interest, but it can also be used to create a system to assist users in developing their wayfinding scheme (Eaton 1991a; Helvacioğlu & Olgunturk, 2011; Jansen-Osmann & Wiedenbauer, 2004; Read, 2003) contributing to supplying information for efficient navigation, and improving children's wayfinding and spatial orientation abilities in their environment (Helvacioğlu & Olgunturk, 2011; Read, 2003). However, out of 435 total signs reviewed in all three libraries, 5.7% (n=25) exhibited poor use of color, and all of these signs were informational signs. While it might seem that 5.7% is a small percentage, only 145 issues were recorded for all signs, meaning color issues comprise 17.2% of all issues. These issues were not about color-coding, but were about use of color that is inappropriate, such as using yellow text on a white background which provides insufficient contrast to render the signs legible and using red on signage that is not regulatory, when red is strongly associated with

regulatory signage (Gibson, 2009).

The wayfinding literature stresses usage of directional signs (Arthur & Passini, 1992), but only 2.3% of all signs in the three school libraries were directional while 14.7% were regulatory and 83.0% were informational. This ratio of directional to other signs is even starker than the ratios found by Stempler and Polger (2013) and Mandel (2012) who found 12% directional, 44% regulatory, and 44% informational and 12.7% directional, 11.7% regulatory, and 75.6% informational, respectively. It seems that even though children require additional help to wayfind, school libraries are utilizing even fewer directional signs than academic and public libraries, and directional signs had more issues of clarity than other signs (See Figure 2), with 20.0% of directional signs being unclear compared to 12.5% of regulatory and 7.2% of informational signs. Improving access to learning resources through provision of directional text-based and graphics-based signage is valuable because directional signs assist in orientation and navigation contributing additional information to the mental image of the environment and therefore contributing to the cognitive map and when students are not given adequate directional cues, including both having sufficient directional signs and ensuring those signs are clear, their disorientation will hinder both wayfinding performance and spatial knowledge acquisition (Arthur & Passini, 1992; Cubukcu & Nasar, 2005; Eaton, 1991a, 1991b; Li & Klippel, 2012).

Figure 2. Total Signs with Issues by Type of Sign

		Directional signs		Regulatory signs		Informational signs	
		%	n	%	n	%	n
total signs							
by issue	Unclear	20.0%	2.0	12.5%	8.0	7.2%	26.0

Wrong location	0.0%	0.0	1.6%	1.0	5.5%	20.0
Placement issues	0.0%	0.0	7.8%	5.0	6.4%	23.0
Not current	0.0%	0.0	0.0%	0.0	0.3%	1.0
Damage to sign	0.0%	0.0	1.6%	1.0	4.7%	17.0
Damage to sign holder	0.0%	0.0	0.0%	0.0	1.4%	5.0
Poor use of color	0.0%	0.0	0.0%	0.0	6.9%	25.0
Other	10.0%	1.0	3.1%	2.0	2.2%	8.0

The most noted issue was with unclear signage (8.3%), which is problematic since there is no point to posting a sign if that sign is not going to clearly explain to the user whatever the sign is trying to convey. The most frequent “unclear” problems were signs that were too small for the amount of information on them or that used text that was too small to read; such signs are serving no purpose, wayfinding or informational. When users cannot read a sign or quickly ascertain what the sign is trying to convey, it would be better to have no sign than the unclear sign. An unclear sign can exacerbate users’ confusion and frustration while seeking information in a school library. This issue was extremely prevalent in the middle school (15.1%) as compared to the elementary (7.9%) and high (4.3%) schools, and as noted above more prevalent in directional signs than informational or regulatory signs. One of the other issues with unclear signs was placing these signs above six or seven foot high stacks, further decreasing their legibility to all but the tallest of people.

Placement of signs in school libraries is especially important in considering the needs of the users because the location and physical placement of the sign must be placed appropriately in relation to the information it is communicating and at the proper height for student users (Eaton, 1991a; 1991b; Eaton, Vocino, & Taylor, 1992). Placement issues were found in the elementary (3.4%), middle (13%), and high schools (5.8%), surprisingly though was that the least amount of issues were found at the elementary level where one might expect there to be more issues in regards to placement of the signs. Whereas placement issues refer to signs in locations that make them hard to see or read, such as too hung too high, pushed back on high shelves, or at odd angles, it can also refer to signs placed in the wrong location in that they are not appropriately placed in relation to the information they are communicating, and considering this was most prevalent among regulatory signs (7.8%) versus directional (0.0%) or informational (6.4%) signs, this suggests the school libraries are not ensuring that regulatory signs are appropriately placed, which could lead to users being unable to find relevant signage during emergency situations. While most of the placement issues at the the elementary school were related to height, the issues at the middle and high schools tended to reflect mis-placement of signs in that they were not placed with the areas or items they represented. The optimal placement of signs is widely addressed in the literature (Brown, 2002; Eaton, 1991a, 1991b; Eaton, Vocino, & Taylor, 1992; Li & Klippel, 2012; Mandel, 2010, 2012, 2013; Pollet & Haskell, 1979) and in order to be effective signs must be visible and placed for the greatest benefit of the user. Often placement of signs is decided by simply available space (Eaton, 1991a, 1991b), but more consideration needs to be put into the placement of signage. If a student cannot see a sign or read a sign because it is placed at the wrong height then these signs as

wayfinding aids become useless in communicating information to students and furthermore if the signs are mis-placed they can contribute to a students' confusion by communicating incorrect information

### **Implications and Future Research**

This research has implications for a variety of school library stakeholders. First is practicing school librarians in their role as program administrators. In this role school librarians are directed to create a learning environment that provides equitable access and meets the needs of all learners (AASL, 2009). This involves designing and organizing a school library, including the purchase or designing of signage. The findings from this research provide valuable information on the different aspects of signage and its value as part of the school library learning environment and are useful for making decisions in regard to purchasing, designing, and placing signage. This information can also be helpful in preparing future school librarians for their role as program administrator and needs more attention in the research and literature of the profession. Learning how to navigate space while seeking information relies on developing children's spatial thinking or visualizing and interpreting location, distance, and direction. As school librarians strive to stay current in educating students in information seeking, the use of signage is an important strategy that can be utilized to improve children's wayfinding and therefore develop spatial orientation abilities in their environment. Therefore, wayfinding, signage, and spatial literacy are important concepts that need to be integrated into school librarian preparation curriculum. As a result of this study, the researchers have added a signage review and evaluation assignment to a school library program administration course. Finally, this information is also useful to interior architects and manufacturers of signage

materials for school libraries, as well as educators and school librarians who sometimes have input on the design of library environments.

There is very limited research in the areas of school libraries and wayfinding and school library facility evaluation methods. This research, both the pilot study reported here and the larger study of which the pilot is a part, will provide great contributions in both areas, supporting school library practice with research-based evidence for decision-making. Next steps for the larger study include developing the full study using an experimental design and children as subjects who will be asked to complete wayfinding tasks in searching for information in a variety of school library facilities, expanding the scale of the study, and modifying the signage assessment instrument to include the newly identified issues with signage that emerged from this study. Another area of interest that emerged from this pilot study that will be incorporated into the larger study is signage and those students with disabilities and investigating if schools are adapting these navigational devices to meet the needs of all learners and how emerging technologies could be utilized to facilitate this.

### **References**

American Association of School Librarians. (2009). *Empowering learners: Guidelines for school library media programs*. Chicago, IL: American Library Association.

Arthur, P., & Passini, R. (1992). *Wayfinding: People, signs, and architecture*. New York, NY: McGraw-Hill.

Babbie, E. (2012). *The practice of social research* (13th ed.). Belmont, CA: Wadsworth, Cengage Learning.

- Baule, S. M. (2007). *Facilities planning for school library and technology centers* (2nd ed.). Worthington, OH: Linworth.
- Beecher, A. B. (2004). Wayfinding tools in public library buildings: A multiple case study. *behavior* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Database. (3126555).
- Brown, C. R. (2002). *Interior design for libraries: Drawing on function and appeal*. Chicago, IL: American Library Association.
- Cornell, E. H., Heath, C. D., & Alberts, D. M. (1994). Place recognition and wayfinding by children and adults. *Memory & Cognition*, 5(6), 633-643
- Cornell, E. H., Heath, C. D., & Rowat, W. L. (1992). Wayfinding by children and adults: Response to instructions to use look-back and retrace strategies. *Developmental Psychology*, 28(2), 328-336.
- Cubukcu, E., & Nasar, J. L. (2005). Relation of physical form to spatial knowledge in large-scale virtual environments. *Environment and Behaviour*, 37(3), 397-17.
- Dempsey, B. (2006). Wayfinding in action: Patrons get to what they want fast at these four libraries. *Library Journal*, 131(9), 14-15. Retrieved from <http://www.libraryjournal.com>
- Eaton, E. G. (1991a). Lost in the library: Are spatial skills important in shelf searches? *Journal of Youth Services in Libraries*, 5, 77-86.
- Eaton, G. (1991b). Wayfinding in the library: Book searches and route uncertainty. *Reference Quarterly*, 30(4), 519-527.
- Eaton, G., Vocino, M. & Taylor, M. (1992). Evaluating signs in a university library. *Collection Management*, 16(3), 81-101.
- Erikson, R., & Markuson, C. (2007). *Designing a school library media center for the future* (2nd ed.). Chicago, IL: American Library Association.
- Everhart, N. (1998). *Evaluating the school library media center: Analysis techniques and research practices*. Westport, CT: Libraries Unlimited.
- Gibson, D. (2009). *The wayfinding handbook: Information design for public places*. New York: NY: Princeton Architectural.
- Gifford, R. (2001). *Environmental psychology: Principles and practice* (3rd ed.). Canada: Optimal Books.

- Hardwick, D, McIntyre, C. & Pick, H. (1976). *The content and manipulation of cognitive maps in children and adults*. Monographs of the Society for Research in Child Development, *Serial No. 166*, 41(3), 1-55.
- Hart, T. L. (2006). *The school library media facilities planner*. New York, NY: Neal-Schuman.
- Hassanain, M. A., & Mudhei. A. A. (2006). Post-occupancy evaluation of academic and research library facilities. *Structural Survey*, 24(3), 230-239.
- Helvacioğlu, E. (2007). *Colour contribution to children's wayfinding in school environments* (Unpublished doctoral dissertation). Ankara (Turkey): Bilkent University.
- Helvacioğlu, E., & Olguntürk, N. (2011). Colour contribution to children's wayfinding in school environments. *Optics & Laser Technology*, 43(2011), 410-419.
- Jansen-Osmann, P., & Wiedenbauer, G. (2004). Wayfinding performance in and the spatial knowledge of a color-coded building for adults and children. *Spatial Cognition & Computation: An Interdisciplinary Journal*, 4(4), 337-358.
- Johnston, M. P., & Bishop, B. W. (2011). The potential and possibilities for utilizing geographic information systems to inform school library as place. *School Libraries Worldwide*, 17(1), 1-10.
- Larkin-Lieffers, P. A. (2001). Informational picture books in the library: Do young children find them? *Public Library Quarterly*, 20(3), 3-28.
- Li, R., & Klippel, A. (2012). Wayfinding in libraries: Can problems be predicted? *Journal of Map & Geography Libraries*, 8(1), 21-38.
- Mandel, L. H. (2010). Toward an understanding of library patron wayfinding: Observing patrons' entry routes in a public library. *Library and Information Science Research*, 32(2), 116-130.
- Mandel, L. H. (2012). *Lost in the labyrinthine library: A multi-method case study investigating public library user wayfinding behavior* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Database. (3519349).
- Mandel, L. H. (2013). Finding their way: How public library users wayfind. *Library and Information Science Research*, 35(4), 264-271. doi:10.1016/j.lisr.2013.04.003
- Mandel, L. H., & Johnston, M. P. (2013). *Are we leaving them lost in the woods with no breadcrumbs to follow? Assessing signage systems in school libraries*. Presentation at the 10th Northumbria International Conference on Performance Measurement in Libraries and Information Services, York, UK.

National Research Council. (2006). *Learning to think spatially: GIS as a support system in the K-12 curriculum*. Washington, DC: The National Academies Press.

National Science Foundation. (2010). *Preparing the next generation of STEM innovators: Identifying and developing our nation's human capital*. Arlington, VA: National Science Foundation. Retrieved from <http://www.nsf.gov/nsb/publications/2010/nsb1033.pdf>

Neuendorf, K. A. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage Publications.

O'Neill, M. J. (1991). Effects of signage and floor plan configuration on wayfinding accuracy. *Environment and Behaviour*, 23(5), 553-574.

Pollett, D., & Haskell, P. C. (1979). *Sign systems for libraries: Solving the wayfinding problem*. New York, NY: R. R. Bowker.

Read, M. A. (2003). Use of color in child care environments: Application of color for wayfinding and space definition in Alabama child care environments. *Early Childhood Education Journal*, 30(4), 233-9.

Stempler, A. F., & Polger, M. A. (2013). Do you see the signs? Evaluating language, branding, and design in a library signage audit. *Public Services Quarterly*, 9(2), 121-135.

Wilson, R. (1997). Environmental education: A sense of place. *Early Childhood Education Journal*, 24(3), 191-194.

Wiener, J. M., Büchner, S. J., & Hölscher, J. (2009). Towards a taxonomy of wayfinding task: A knowledge-based approach. *Spatial Cognition & Computation*, 9(2), 152-165.

