A Study of Rural Librarians' Self-Efficacy in Facilitating and Developing Adult Science Programs

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ABSTRACT

Rural libraries are central hubs for their communities and for sharing knowledge. For these reasons, they are an essential component of community science literacy. As part of the "Rural Gateways" project, researchers examined the science attitudes and self-efficacy of rural librarians and how these variables relate to librarians' identity as science program developers. From across the United States, 110 rural librarians filled out a questionnaire measuring their science self-efficacy. Although most librarians reported high levels of science self-efficacy, some statistically significant differences existed between subgroups. On average, librarians with above-average science self-efficacy were significantly more likely to view themselves as developers of adult science programming. In many cases, librarians previously were involved in creating adult science programming within their rural communities. We discuss our findings in relation to current understandings of self-efficacy and library practice, as well as implications for learning in informal science education settings more broadly.

As the library profession considers and discusses the role of the public library in fostering lifelong learning, promoting civic engagement, and building social capital, inquiries into the area of librarian self-efficacy in delivering science programming are particularly timely. Recent publications reflect the importance of these issues, including the Aspen Institute's (2014) *Rising to the Challenge: Re-envisioning Public Libraries* and the American Library Association's (2016) annual *State of America's Libraries* reports. Public libraries have a long history of providing learning opportunities to adults and serving as community centers for dialogue and discussion. From their inception, American public libraries have always striven to be agents for educational advancement and learning, providing the public with carefully selected collections of books. As Paul T. Jaeger et al. (2013) note, "From the beginning of the American repub-

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lic, some leaders saw the library as a social institution that could simultaneously diffuse knowledge to members of society and prevent the wealthy and socially elite from having hegemonic domination over learning and education—although it was those elite who selected materials for library patrons" (26). Over the past 2 decades, public libraries have certainly expanded their educational roles through such efforts as literacy initiatives; collaboration with local schools and higher education institutions; community outreach to businesses, senior centers, and local organizations; and book and film discussion programs (Goodman 2015; American Library Association 2016; Cohen 2017). More recently, reader's advisory, technology training, and information literacy instruction have received increased emphasis (Kolle and Parmeshwar 2014; Real, Bertot, and Jaeger 2014; Mehra and Singh 2017). Most literature about these programs and services is practice based, covering the practical, how-to aspects of developing programs, promoting professional development, and establishing services (Mehra et al. 2011). Conspicuously absent have been related investments in research on the processes necessary to make this transition and the efficacy of those efforts made in the past. This article presents initial findings of a research to practice project focused on expanding the adult science education capacities of rural libraries.

Libraries and Science Learning

Library-centered initiatives to increase the public's awareness and understanding of science have been growing over the past decade, in large part due to the exponential growth in the importance of science literacy in society, as highlighted in 2015 in *Public Libraries and STEM: A National Conference on Current Trends and Future Directions* (National Science Foundation 2015). Although public science literacy is a lifelong learning issue, the overwhelming majority of science-related library programming is focused on children and teens (e.g., Walter 2003; Evans 2017; Pandora and Fredrick 2017). And while a few libraries have sponsored discussion programs for adults in connection with massive open online courses and science-focused TED talks, generally science programming for adults remains relatively limited (Massis 2013). Lagging even further behind have been efforts designed to reach adults in the rural segments of the United States with much of library-based science learning efforts happening in urban and suburban areas (e.g., Pandora and Fredrick 2017). This is unfortunate because rural libraries are particularly well situated to serve as educational gateways to the public's science learning.

Rural Libraries, Science Learning, and Professional Development

[Rural libraries] foster the kinds of social harmony that community spaces and stories—experienced and shared—provide.

—W. Wiegand (2011, 48)

In this study we define rural libraries as the collection of libraries in the rural fringe, rural distant, and rural remote areas (National Center for Educational Statistics 2006). Nearly 50% of libraries in the United States fall within these defined rural communities (American Library Association 2012; Real and Rose 2017), and visitation rates per capita to rural libraries dwarf visitation rates to urban libraries (Grimes et al. 2013). Rural libraries are often at the center of their communities, creating opportunities for influence that exceed those of the typical urban or suburban library (Rosser-Hogben 2004; Vavrek 2008; Berry 2009). By focusing on the positive role rural libraries play in facilitating civic engagement and community learning, scholars expose rural libraries' ability to bring together community partners across familial, sociocultural, economic, and political divisions (Vavrek 2008; White 2014; Real and Rose 2017). For instance, researchers working on the economic implications of rural libraries have found library services are paramount to the economic growth of rural areas, connecting individuals with training programs and business needs (Skrzeszewski and Cubberley 1997; Mehra, Bishop, and Partee 2017). However, not only researchers have begun to understand the vital role these libraries play in their communities, but also both the federal and state government levels are recognizing the contributions of libraries to the economic, cultural, and social capital of their communities (cf., Miller 2017).

Yet even with research illustrating the importance of rural libraries to their communities, these libraries face several operating difficulties. Major impediments exist in supporting rural libraries in expanding the scope and scale of their science activities. Research by John H. Falk, Jennifer Bachman, and Michael Liu (2011) found a key deterrent to expanding science programming for all libraries, but particularly for small rural libraries, is staff. Commensurate with their size and typically limited budgets, rural libraries often have very small staffs (as small as one single person), and the staff they do have typically possess less academic training than those in suburban or urban libraries (Flatley and Wyman 2009). In addition, rural librarians also have considerably less access to ongoing professional training (Flatley and Wyman 2009). Despite these challenges, rural librarians consistently have high job satisfaction, finding their work to be "rewarding, service oriented and intellectually stimulating" (Flatley and Wyman 2009, 27).

Creating meaningful professional development is challenging enough when faced with the "normal" responsibilities of a librarian but becomes particularly acute when efforts are made to expand rural librarian roles and responsibilities, for example, in the area of science programming (Mehra et al. 2011). One professional development program, Information Technology Rural Librarian, pioneered a solution to this challenge with practical online training to increase rural librarians' technological capabilities (Mehra et al. 2017). From a professional development perspective, this form of online training for rural librarians is an effective way of empowering librarians and community partners to expand science programming. While not an explicit outcome, one of the innovations of the approach of Mehra et al. (2017) was a focus on improving librarians' self-efficacy in delivering information technology services in their rural communities.

Self-Efficacy

The focus of Mehra et al. (2017) on self-efficacy was important because self-efficacy—defined as the extent or strength of one's belief in one's own ability to complete tasks and reach goals—has been consistently shown to be critical to job performance (Bandura 1997; Ormrod 2006). In other words, for individuals to successfully play a professional role, they need to believe they possess the skills and competencies required of that role. As discovered by Falk et al. (2011), virtually all rural librarians held considerable self-efficacy for such traditional librarian roles as helping patrons find books or research a topic, but many indicated a lack of self-confidence in assuming other types of roles, particularly the role of an active facilitator of informal science learning (ISL) programs targeted at adults.

This project builds on four dimensions of efficacy: attitudinal, personal interest/emotion, career, and collective efficacy. According to Dennis W. Organ's (1990) research on self-efficacy, positive attitudes and beliefs related to new tasks have been shown to positively influence individuals' performance, while Reinhard Pekrun et al. (2011) found linkages exist between the state of individuals' emotions and their self-efficacy, motivations, and performance. By reducing or altering individuals' negative emotional states, we are able to positively influence their perceptions of their own capabilities and thus their performance (Bandura 2001). Several studies on individuals in career transitions found that supporting positive self-efficacy and, therefore, attitudes and emotion was key to the success of individuals in career-relevant learning and skill development (Bailey 1994; Bandura 2001). These three dimensions of self-efficacy are positively related to collective efficacy: "each individual's assessment of their team's collective ability to perform job-related behaviors" (Riggs 1989, 7). Taken in sum, these four dimensions of efficacy contribute to an organization's overall levels of success (Bandura 1993).

We use the term "science self-efficacy" to describe how comfortable an individual is in carrying out science activities, including talking about, participating in, and understanding science. Librarians' level of comfort with science topics is likely to influence how they handle the responsibilities of partnerships with community groups and organizations, approach planning and implementation of programs, create science-related services, and build collections emphasizing science topics and issues. Individuals who lack a basic comfort with science are more likely to perceive science learning as something falling outside of their comfort zone, personally and professionally, and are much more likely to be resistant to implementing science programming, particularly for adults.

For librarians to actively pursue a deeper understanding of science topics, let alone to feel confident in facilitating such efforts, requires a minimal level of self-efficacy that Falk et al. (2011) found to be generally lacking. An extensive literature, mostly conducted within the formal education system, has documented the key role leader self-efficacy plays in the support of science learning (e.g., Gibson and Dembo 1984; Riggs and Enochs 1990; Tschannen-Moran, Hoy, and Hoy 1998; Tschannen-Moran and Hoy 2001; Bandura 2006; McKinnon and Lamberts 2013).

The classic example of this is found among elementary school teachers who generally exhibit low self-efficacy in science, which in turn leads to low self-efficacy in facilitating science learning in others and a decrease in the number of science activities offered in classrooms (Cantrell, Young, and Moore 2003; Rice and Roychoudhury 2003; Bleicher 2007). Limited but corroborating research exists within the informal science education context (e.g., Smith 2011). One study related to science efficacy and librarians also appeared to corroborate these findings. Don Latham et al. (2016) investigated the perceptions and experiences of science teachers and school and public librarians (primarily youth services librarians) with interprofessional collaboration and found that public librarians noted several barriers to successful collaboration, including lack of science training and, as a result, feeling insecure about collaborating with science teachers. Likewise, school librarians indicated their lack of a science background sometimes made them reluctant to approach science teachers for collaboration due to their own unfamiliarity with science (Latham et al. 2016).

Additional support comes from a small number of studies that investigated librarians' self-efficacy in topic areas other than science. In an investigation of potential obstacles to public libraries' active participation in lifelong learning initiatives, Connie Van Fleet (1990) identified the reluctance of public librarians to assume a nontraditional role as one barrier. A study of school librarians' involvement in different dimensions and stages of reference and information literacy instruction found the degree of involvement was influenced by the professional self-efficacy of school librarians and their perceptions of their role within the school community (Ash-Argyle and Shoham 2014). Noa Aharony (2009) investigated whether personality characteristics (e.g., empowerment, extroversion, and resistance to change) influenced the attitudes of academic librarians, public librarians, and school librarians toward science programming in libraries and found positive, significant correlations between all examined personality variables except the variables of decisiveness and pro-science attitudes. Research about the connection of social competence skills (e.g., listening, communication, tactfulness, clientele focus) to the computer and internet self-efficacy of academic librarians reveals that social competence could positively influence these two dimensions of self-efficacy (Tella, Tella, and Adekunle 2007). Collectively, these results suggest any effort to advance the goal of encouraging rural public librarians to more actively engage as facilitators of science learning needs to address the issue of librarians' science self-efficacy.

Rural Gateways Project

With support from the US National Science Foundation (DRL-1515241), the "Rural Gateways: Fostering the Development of Rural Librarians as Informal Science Facilitators" project seeks to create a research-based, scalable, professional development effort to support rural librarians as agents for increasing the likelihood and frequency of high-quality, sustainable informal science programming in rural communities throughout the United States. The project provides

librarians with online professional development and scaffolded experiences, leveraging their community service motivation to increase their science self-efficacy and, most importantly, to build their self-identification as science program developers. The Rural Gateways project is interested in identifying factors influencing a librarian's movement along a spectrum of ISL roles, from perceiving oneself as a convener of science programs, to a facilitator of ISL activities, and finally to an informal science educator and developer—someone capable of developing and successfully running ongoing ISL programs. The Rural Gateways project builds upon an earlier iteration of a rural library support program, "Pushing the Limits," which found that online professional development was successful in supporting rural librarians to become conveners of adult science programming but only occasionally resulted in librarians become self-sufficient facilitators of adult science education programming (Gareis, Lukasiewicz, and Goodman 2014).

To test the efficacy of the Rural Gateways concept, the project was designed as a quasi-experimental study, with two levels of professional development intervention: one more extensive and intensive (treatment group A) and one modeled after the more limited online professional development program developed as part of the Pushing the Limits project (treatment group B; cf., Gareis et al. 2014); a third group with no professional development intervention was included as a control group. This article reports on national baseline survey results collected from the two treatment groups ($n = 110$ librarians). It examined librarians' beliefs about their role in developing and delivering adult science programing within rural communities, as well as self-assessments about their individual abilities to participate in science. The project team's ultimate goal is determining whether changes in science self-efficacy can be used as a reasonable proxy for understanding the progress rural public librarians make in transitioning along the continuum from being passive science education program conveners to active science education developers.

Research Questions

The following research questions guided this inquiry: (1) Does the science-related self-efficacy of US rural librarians, as measured in a sample of librarians participating in the Rural Gateways project, correlate with the science competencies, attitudes, and dispositions required to be an effective informal science educator? (2) Does the science-related self-efficacy of US rural librarians, as measured in a sample of librarians participating in the Rural Gateways project, correlate with a professional identity as a facilitator and developer of ISL programs for rural adults?

Methodology

Invitations to participate in the Rural Gateways project were extended via state and national email listservs and distributed at a few state and national library conventions, including, for example, the 2016 American Library Association Midwinter Meeting in Boston, the Illinois Heartland Library System, and the Midwest Library Association Listserv. We invited state librarians,

state continuing education officers, and state library consortia as well to distribute the invitation to their members and networks. More than 300 libraries applied to participate, providing demographic information about their library and their community, information about their experience providing science-related and adult programs, and statements on how they believe their community can benefit from participation in this project. Rural Gateways project team members rated applications, selecting 110 librarians based on achieving a representative national sampling of US rural libraries and librarians. Criteria included geographic distribution, size and nature of the library, socioeconomic diversity of communities served, and the ability of the host library or librarian to fulfill the needs of the grant (e.g., commitment of library administration, understanding and commitment to time requirements, and adequacy of internet connection). Selected librarians were predominantly female (58%, $n = 89$) and ranged in age from 27 to 70, with an average age of 43. These demographics align with earlier studies of rural librarians (Flatley and Wyman 2009; Real and Rose 2017).

Once selected, the program team sent a baseline questionnaire prior to the start of the professional development program. The questionnaire primarily consisted of a series of items, each utilizing a 7-point, Likert-type scale, asking respondents to rank their level of agreement from 1 ("strongly disagree") to 7 ("strongly agree"), organized into four sections: (1) attitudes toward science, (2) personal interest in science, (3) career-related beliefs, and (4) beliefs about their library's collective ability (cf., Bandura 1993; Maurer and Tarulli 1994; Ross, Cousins, and Gadalla 1996; Bandura 2001; McNatt and Judge 2008; Pekrun et al. 2011; see appendix).

Questions concerning the participants and their role in their library (15 questions) focused on the role of the participants, their skills as librarians, and association with the local public library. Questions concerning participants' attitudes toward and experience with facilitating adult programs (17 questions) asked participants how strongly they agreed with statements concerning how they felt about running adult programming, as well as their experience running adult programming. Questions concerning perceptions of science (19 questions) asked participants how strongly they agreed with statements concerning their ability to carry out science tasks, their attitudes toward science, and their experience with science. Questions concerning perceptions about their library's collective role in the community (12 questions) asked participants how strongly they agreed with statements concerning characteristics of and actions by the library in which they work, as well as their roles in their library.

Data Analysis

Quantitative Analysis

Rural Gateways project team members entered survey responses from closed-ended (quantitative) questions into an Excel spreadsheet in preparation for analysis in the statistical software package IBM SPSS. The quantitative analysis was conducted using simple percentages and statistics to evaluate patterns in librarians' responses.

Qualitative Analysis

Qualitative questionnaire data were analyzed to identify emergent patterns and themes. We coded responses following a standardized but fully inductive process. The first step in the data analysis was line-by-line coding of questionnaire responses, using an "open coding" strategy (Strauss and Corbin 1990). Data were further examined to determine whether correspondences existed between the various coding categories. If it was determined comparability existed between categorical elements, we further analyzed data and, as necessary, categories were collapsed or refined (Strauss and Corbin 1990).

Science Self-Efficacy Scoring

We calculated science self-efficacy scores based on 24 of the closed-ended survey questions. Each of the 24 questions specifically related to one of the four measures of self-efficacy—attitudinal, personal interest/emotion, career, and collective efficacy—as measured by librarians' perceptions of their abilities, attitudes, and career competencies. Likert scales were scored from strongly disagree (−3) to strongly agree (3) for positively framed questions and from strongly disagree (3) to strongly agree (−3) for negatively framed questions with midpoint responses (neither agree nor disagree) scored as 0. Given the highest score of 3 and the lowest score of −3 for each individual question, we arrived at a potential science self-efficacy score ranging from −72 to 72 for all 24 questions.

Results

Participating Librarians and Their Roles

As part of the baseline survey, we asked librarians to indicate their job title. Half (51%, $n = 56$) of respondents indicated they were the director of their library while 13.3% ($n = 15$) of librarians claimed to hold a role in program coordination and 11% ($n = 12$) fulfilled some type of managerial role. Other respondents varied in their roles from facility maintenance to volunteer roles.

We next asked respondents to list their primary job responsibilities. The primary responsibility of participating librarians was some form of programming, with 24.8% ($n = 27$) of responses indicating they ran some type of adult or child programming in their library. Administrative duties also composed a large component of librarians' responsibilities with 10.9% ($n = 12$) of librarians indicating their primary responsibility was general administration, followed by general library duties (8.6%, $n = 9$), financial duties (5.2%, $n = 6$), facility management (4.3%, $n = 5$), circulation (4.3%, $n = 5$), and online administration (3.4%, $n = 4$). Marketing and public relations also composed a primary duty for some (6.3%, $n = 7$). When asked why they decided to take a role in libraries, the top five answers were (1) they wanted to be a part of the positive contribution the library made to the community (11.0%, $n = 12$), (2) they loved to read (9.5%, $n = 11$), (3) they wanted to help people (7.1%, $n = 8$), (4) they generally love the

culture of libraries (6.0%, $n = 7$), and (5) they had worked in another library previously (5.7%, $n = 6$). However, when looking across all the responses, we found most librarians took the job for primarily self-related reasons (61.8%, $n = 68$), such as being able to satisfy their love of literature, rather than more altruistic reasons (38.2%, $n = 42$), such as to serve their community. These results align with prior findings on why rural librarians enter and remain in the field (Flatley and Wyman 2009).

As part of our effort to understand librarians' self-efficacy, we also asked questions that attempted to determine which of their current skills librarians felt they were best at and which skills they thought they most needed to improve. Overwhelmingly, 63.5% ($n = 70$) of librarians agreed that among their top three skills were their interpersonal skills, 35.7% ($n = 39$) rated "general customer service" among their top skills, and 27.7% ($n = 30$) rated their ability to offer programming as one of their top three skills. In contrast, 54.8% ($n = 61$) of librarians agreed the skill they most needed to improve was their organizational skill with 38.9% ($n = 43$) of librarians stating their interpersonal skills were what they needed to improve the most. The third most cited skill librarians felt they needed to improve was their planning skill with 33.7% ($n = 37$) of librarians stating it was one of their top three skills needing improvement.

Science Participation

To begin to understand the science background of the librarians, we asked if they had participated in a science activity within the last year and the great majority, 88.2% ($n = 97$), self-reported that they had participated in a science activity. When asked to describe the science activity they had participated in, the top three responses were (1) visited a science center/museum (25.4%, $n = 28$), (2) read a science book (24.1%, $n = 27$), and (3) watched a science television program (22.3%, $n = 25$).

Another component of this question measured with whom and in what general area of science these activities occurred. Nearly half (43.5%, $n = 48$) of respondents took part in a science activity through an organization, whereas 41.3% ($n = 45$) took part with a family member, and another 15.2% ($n = 17$) indicated that they participated in a science activity with a friend. The most frequently mentioned areas of science librarians self-reported participating in were engineering (14.7%, $n = 16$), digital arts (13.3%, $n = 15$), astronomy (10.7%, $n = 12$), horticulture (9.3%, $n = 10$), and outdoor pursuits (9.3%, $n = 10$).

Librarians and Adult Programming

To understand the effects of self-efficacy in creating and implementing science-based discussion programs for adults, we began by asking about librarians' experience with facilitating or directing programs for adults in their libraries. Nearly all librarians (90.9%, $n = 100$) reported having directed some type of adult programming in their libraries; only 3.6% ($n = 4$) indicated that they had never done so. Of those who had facilitated an adult program, the top five pro-

grams mentioned were (1) leading a reading club (12.9%, $n = 14$), (2) leading a technology program (11.9%, $n = 13$), (3) inviting in a guest speaker (11.0%, $n = 12$), (4) leading a crafting class (7.0%, $n = 8$), and (5) hosting a movie night (4.5%, $n = 5$). Although 51% ($n = 56$) of librarians stated they developed these programs, 29.3% ($n = 32$) of librarians indicated someone other than themselves developed their programs, and 19.3% ($n = 21$) of librarians developed programs in partnership with either other community members or library staff. Of those who hosted an adult program, 30% ($n = 33$) facilitated an adult science program.

Science Self-Efficacy Ratings

This sample of rural public librarians felt reasonably confident about their abilities related to science with overall self-efficacy skewing positively (fig. 1). The mean self-efficacy score was 33 points, with a range of −5 to 60. For this reason, we opted to take a norm-referenced approach to analyzing the results, looking for differences within our population of librarians by their relative predisposition toward science. In other words, we analyzed librarians in relation to the average librarian in this cohort, even though this may not mirror the average rural public librarian score. As the distribution was essentially normal, we chose to divide the population into two groups with those scoring above the mean self-efficacy score of 33 defined as the above-average science self-efficacy group (AASE) and those with self-efficacy scores below 33 as the below-average science self-efficacy group (BASE).

Efficacy and Science Attitudes

As table 1 illustrates, AASE respondents were significantly more likely than BASE respondents to feel comfortable leading a science program for adults, working with scientists, and answering adult patrons' questions related to science, even if they did not identify as experts. AASE respondents were also significantly more likely to enjoy being in front of an adult group and significantly less likely to want to stay in the background.

Finally, we examined the relationships between self-efficacy and how librarians placed themselves along a convener-facilitator-developer continuum. Figure 2 illustrates the relationship we found between science self-efficacy and a librarian's identity as a program developer.

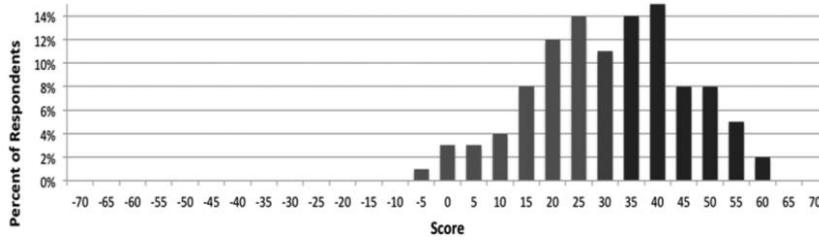

Figure 1. Science self-efficacy scores of rural librarians participating in Rural Gateways

Table 1. Librarians' Science Attitudes by Above- and Below-Average Science Self-Efficacy

	Above-Average Self-Efficacy		Below-Average Self-Efficacy			
Statement	*n*	Mean	*n*	Mean	χ^2	Sig.
I like being up at the front and being in charge of adult groups.	51	4.59	59	5.75	26.059	.000
I find it difficult to get adult patrons engaged in discussion.	50	3.94	59	2.56	27.969	.000
Even when leading an activity where I lack deep content knowledge, I am comfortable answering adult patron's questions.	51	4.18	59	5.17	20.115	.003
I believe I have something to offer my community, which comes through when I create adult programming.	51	5.53	59	6.42	30.212	.000
I am not an expert and prefer to stay in the background.	51	3.98	59	2.75	23.448	.001
I find it difficult to make activities meaningful for adult patrons.	51	3.94	59	2.25	42.453	.000
I am a vocal advocate of library outreach in my community.	51	5.92	59	6.42	17.861	.001
I like to learn about science.	51	5.75	59	6.49	28.594	.000
If I am asked to provide assistance on a science subject that is outside of my general knowledge, I can usually find the information for my patrons.	51	5.63	59	6.36	34.747	.000
I enjoy working with scientists.	51	4.90	59	6.05	32.070	.000
I find science to be boring	51	2.20	59	1.41	21.467	.000
I get tense and nervous when adult patrons ask me to support their science interests.	51	2.90	59	1.83	22.359	.000
I am comfortable leading science programs for children but not adults.	51	3.76	59	2.29	32.824	.000
I feel embarrassed when I can't absorb science concepts.	51	4.55	59	2.81	34.026	.000
I enjoy acquiring new science skills.	51	5.78	59	6.56	26.695	.000
It is difficult to communicate with scientists about their research.	51	3.92	59	2.49	32.278	.000
I am comfortable leading science programs for adults.	51	4.08	59	5.86	47.728	.000
Even with good professional training, I am not sure I would be able to lead a science-learning program for adult patrons by myself.	51	2.65	59	1.54	30.110	.000

The mean rating for someone who had AASE was 6.42 (SD = 2.44), whereas the mean rating for someone who had BASE was 4.43 (SD = 2.71). These differences were statistically significant ($\chi^2 = 14.61$, $p = .001$), indicating on average librarians with AASE were significantly more likely to view themselves as developers of adult science programming. In fact, in many

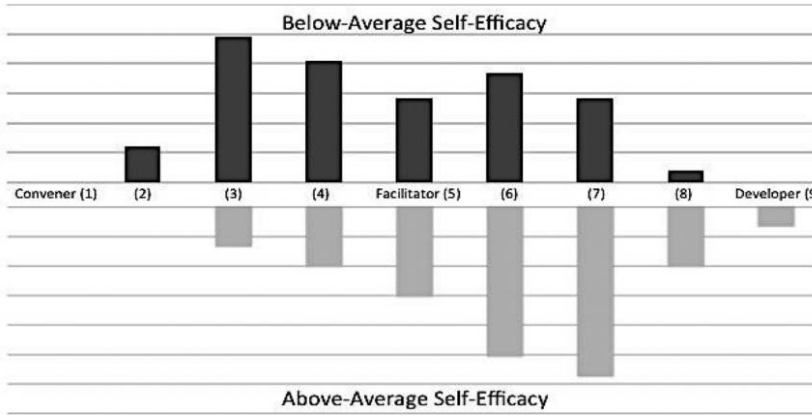

Figure 2. Comparison of librarians with above- and below-average science self-efficacy with their self-reported comfort as a program developer.

cases AASE librarians were already involved in creating meaningful adult science programming within their rural communities prior to the start of the Rural Gateways project.

Conclusions

The Rural Gateways project is interested in identifying factors that might influence the ability of a rural public library to successfully implement and facilitate adult science-related programming with a focus on the role science self-efficacy plays in this process. Specifically, the project is designed to determine whether it is possible to support, through online professional development activities, the movement of a librarian along a continuum of ISL roles from being someone who is merely a convener of science programs to ideally someone who is fully empowered, self-motivated, and capable of independently developing and running science learning experiences for adults. Although the data collected for this study are still preliminary, representing only the baseline component of an ongoing, still larger study, they provide important and useful findings.

There was evidence that differences in science self-efficacy existed within this population of 110 US rural librarians. As predicted, these differences in science self-efficacy appeared to significantly correlate with differences in the self-reported science competencies, attitudes, and dispositions of participating librarians—competencies, attitudes, and dispositions that are important to being an effective informal science educator.

Observed differences in science self-efficacy appeared to also, as predicted, significantly correlate with participating librarians' self-identification along the continuum between being merely a convener of adult science education programs at one end and being a more actively engaged and proactive facilitator and developer of informal science educational programming at the other end. This positive relationship between science self-efficacy and multiple factors

underlying what we believe is required to encourage rural librarians' efforts to support adult science programming in rural settings reinforced our assumptions that a focus on improving science self-efficacy should be a key aspect to include in any professional development effort. Collectively these baseline results also reinforced our belief that changes in librarians' science self-efficacy were likely to be a useful indicator for assessing the long-term efficacy of the Rural Gateways project, particularly its desired goal of helping rural librarians transition from passive science education program conveners to active science education facilitators and developers. One caveat is that possible ceiling effects due to the positively skewed nature of initial science self-efficacy among Rural Gateways participants might hinder this assessment because this strong initial sense of science self-efficacy potentially leaves little room for the project to effect improvement.

Nevertheless, the data showed that individuals who scored below average on science self-efficacy were more likely than those scoring above average to feel uncomfortable in front of adult groups and to lack confidence in leading a science program for adults. These individuals were more likely to want to stay in the background during a program, may be reluctant to answer science-related questions that might arise, and generally were less likely to feel comfortable speaking with and interacting with scientists. These are skills that the Rural Gateways professional development effort is intended to support and ideally will be able to effectively improve.

Of course, the findings from this investigation cannot be fully generalized to the broader population of US rural librarians because we collected data only from individuals who self-selected to participate in a project clearly advertised as being about adult science education. In fact, although efforts were made to select participants who were broadly representative of US rural libraries—geographically, demographically, and functionally—clearly these initial findings reinforce the assumption that along the dimension of comfort with science, this particular cohort of 110 rural librarians was unlikely to be comparable to other US rural librarians, although it is currently impossible from current data to say this with assurance. Still, even assuming that the Rural Gateways cohort is more inclined toward science than the norm, results suggest that the basic premise of the project is sound; that is, science self-efficacy and issues related to comfort with and competence in science are indeed relevant issues. The results also reinforce the project's assumption that the success of this informal science education professional development effort likely hinges on how effectively these issues are addressed.

However, the results of this initial analysis potentially transcend the specifics of science self-efficacy. The results would suggest just how important the issue of self-efficacy is likely to be for professional development efforts regardless of the topic being addressed. They suggest any effort to move librarians toward a different model than that they were initially trained to do will require attention to the issue of self-efficacy.

As the library profession continues to strive to broaden its roles within communities, seeing the fostering of lifelong learning as an increasingly important role, projects like Rural Gate-

ways can provide a useful empirical foundation. The redefinition of libraries as not merely repositories of societies' intellectual efforts but also as proactive promotors of intellectual engagement and free-choice learning—in other words, as not merely curators of knowledge but also as educators—creates both opportunities and challenges for the library community. For libraries to make this transition, it is essential that those who actually work with the public, including and particularly those such as many rural librarians with limited formal training, have the ongoing professional learning support they need to adjust to these changing roles and expectations for libraries and librarians in the twenty-first century.

Rural libraries are particularly well situated to serve as free-choice learning gateways for their communities. However, for rural libraries to fulfill this role and truly impact their communities in this way will require providing robust and meaningful professional development efforts to ensure that all librarians working in these settings possess not only the capacity and competencies required of these new roles but also the self-confidence needed to take on these new and emerging responsibilities. This research points to one way of framing these issues. Of course, this is a small and preliminary step in that direction but potentially an important one.

Appendix
Rural Gateways Background Survey

About You and Your Current Role at the Library

1. What is your name?
2. Within what library do you currently work?
3. What are your responsibilities in your current role at the library?
4. What encouraged you to take a job within a library?
5. What parts of your job do you most enjoy?
6. What parts of your job do you least enjoy?
7. At what skill(s) as a librarian would you say you are best?
8. What skill(s) as a librarian would you say you most need to improve?
9. If you were to think about the following statements, to what extent would they describe you at work?

    a. I am proud of the work that I do.
    b. When I get up in the morning, I feel like going to work.
    c. I find it difficult to detach myself from my work.
    d. I enjoy collaborating with other people to create programs at work.
    e. The type of work I do now is the only type of work I can imagine doing.
    f. When taking on new roles in my career, I always persevere even when things do not go well.
    g. I find the work that I do full of meaning and purpose.

About You and Facilitating Programs

10. Are you ever called on to facilitate or direct programs for adults at the library?
    If yes,

    a. What types of programs and activities for adults have you facilitated?
    b. Did you develop these programs and activities, or were they developed for you?

    If no,

    c. Is there any particular reason why not?

11. Whether you've acted in the role of a program leader or not, please rate your agreement with the following statements related to facilitation of adult programs.

    a. I like being up at the front and being in charge of adult groups.
    b. I find it difficult to get adult patrons engaged in discussion.
    c. Involving experts, such as scientists, is an essential part of any adult educational programming.
    d. The librarian's main job in adult programming is ensuring that people show up for the program.
    e. I feel most comfortable leading programs when I have a script beforehand that I can follow.
    f. Even when leading an activity where I lack deep content knowledge, I am comfort able answering adult patrons' questions.
    g. I believe I have something to offer my community, which comes through when I create adult programming.
    h. I am not an expert and prefer to stay in the background.
    i. I am more comfortable working with children than with adult patrons.
    j. I find it difficult to make activities meaningful for adult patrons.
    k. I see adult facilitating adult programs as a good way to have an impact in my community.
    l. I am a vocal advocate of library outreach in my community.
    m. I think leading adult educational programs should be the job of experts or specialists.
    n. Unless an adult patron explicitly asks for my help, I tend to let patrons explore the library by themselves.

About You and Science

12. What comes to mind when you think of "science"?
13. Have you participated in a science activity (such as reading a book about science, watching a science-related television show, or going to a science museum) during your

own leisure time during the last 6 months?
Yes (1), No (2), Unsure (3)

a. If yes, in what types of activities have you participated?
b. If no, is there any particular reason why not?

14. To what extent do you agree with the following statements about your relationship with science?

a. I like to learn about science.
b. If I am asked to provide assistance on a science subject that is outside of my general knowledge, I can usually find the information for my patrons.
c. I enjoy working with scientists.
d. I'm often afraid I don't know as much about science as people think I do.
e. I find science to be boring.
f. I get tense and nervous when adult patrons ask me to support their science interests.
g. I am comfortable leading science programs for children but not adults.
h. I am more comfortable facilitating an adult science program if I have an expert scientist as a partner than if I facilitate the program alone.
i. I feel embarrassed when I can't absorb science concepts.
j. I enjoy acquiring new science skills.
k. I am interested in designing science programs for adult patrons.
l. It is difficult to communicate with scientists about their research.
m. I am comfortable leading science programs for adults.
n. Even with good professional training, I am not sure I would be able to lead a science-learning program for adult patrons by myself.

15. If you have ever facilitated an adult science program in a library, what were the best aspects of that experience for you?
16. If you have ever facilitated an adult science program in a library, what were the worst aspects of that experience for you?
17. What (if any) additional skills or knowledge do you feel you would need in order to regularly facilitate science programming for adults in your community?
18. Where or to whom would you go for information or advice related to facilitating science programming for adults?
19. Where or to whom would you go for information or materials on science content?

About Your Library and Science

20. To what extent do you agree with the following statements about your library's ability to facilitate science programming for adult publics in your community?

a. My library is currently meeting the science-related needs of the adults in the community.
b. Staff at my library are already stretched thin because of all the things we do.
c. We have not had great success in the past developing science public programs for adults.
d. By becoming involved in community outreach, such as library programming, scientists can help strengthen community interest in science.
e. My library has above-average capabilities in supporting the adult public's science needs.
f. There is a need in my community for programs on local science issues.
g. My library has had a great impact on science engagement by adults in the community.
h. My library is not very effective in engaging our community of adults in science-related programs.
i. In my experience, scientists do not understand how to create programs at the library that are of interest to my community.
j. My library is poorly resourced in science compared to other libraries in similar communities.

21. What do you see as the biggest challenge(s) for facilitating science programming for adults within your library?
22. What do you see as the biggest opportunity(ies) for facilitating science programming for adults within your library?
23. What do you see as the difference between convening and facilitating science programming for adults?
24. What do you see as the difference between facilitating and developing science programming for adults?
25. Where would you place yourself along the following continuum from science program convener to science program developer with a midpoint of science program facilitator?

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