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Competences of Librarians in Performing Different Roles in Citizen Science Projects

Objective. The objective of this article is to explore the skills of librarians in academic and public libraries as they engage in diverse roles within citizen science. **Methods.** The method of this research was focus group discussions to determine the competences required by public and academic librarians for citizen science and the best ways to cultivate these skills. **Results.** The results of the group discussion revealed that libraries are primarily seen as facilitators of citizen science, focusing on organising communication and information sharing, delivering training and coordinating other related activities. Librarians require a range of skills, including organisational, communication, educational, public speaking / knowledge transfer, information and digital literacy, and analytical abilities along with more specific research skills. When initiating projects, librarians also need expertise in the relevant scientific field, project writing, team management, and financial literacy. Differences between academic and public librarians were noted, based on the specific activities they engage in and the communities they serve. **Conclusions.** Librarians are well positioned to serve as facilitators of citizen science by fostering community engagement, nurturing relationships and providing essential resources that support research and foster public participation. However, many librarians currently lack sufficient knowledge, understanding and motivation to engage in citizen science activities. Although librarians already possess many of the core competences needed for citizen science activities, these skills must be tailored specifically to citizen science contexts, continuously updated and supplemented with specialised competences that are not typically found in library settings. Librarians can acquire these skills by actively participating in citizen science projects and learning from experienced colleagues, as well as through training programmes or self-directed online learning.

Keywords: citizen science; library role; librarians' competences; competence development

Introduction

Citizen science is one of open science components, where libraries are increasingly involved. Citizen science is not a well-defined concept, but it is commonly described as citizen participation in scholarly research (Bogert et al., 2022), or the collaboration between citizens and scientists in the production of scientific knowledge (Lorke, Golumbic, Ramjan, & Atias, 2019; Roche et al., 2020). Libraries play an important role in supporting citizen science by acting as community hubs that facilitate public participation in research (Ignat, Cavalier, & Nickerson, 2019). Through citizen science initiatives, libraries engage volunteers and allow them to contribute to meaningful research projects. Not only does citizen participation enhance scientific literacy but also fosters a sense of community belonging and commitment. In addition, libraries can promote community building by creating links between volunteers and researchers, which is essential for the success of citizen science initiatives. Library provides the necessary resources, such as spaces and facilities, technology and data curation (Cohen, Cheney, Khue Duong, Lea, & Unno, 2015). Moreover, partnerships between libraries, universities and community-based organisations can further improve public engagement in citizen science projects creating a stronger framework for collaborative research. For librarians, there is an urgent need to transform their roles, services and products to effectively engage in citizen science activities. Furthermore, a dedicated team needs

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to be assigned in the library to be responsible for providing services for citizen science (Rammutloa, 2023).

Librarians, who usually represent the roles of mediators or facilitators in citizen science, are accountable for ensuring effective communication between citizen science participants and researchers and/or project organisers, as well as developing the necessary citizen science competences in other participant groups. For this, not only is it necessary to have a general understanding of citizen science activities and good communication and educational skills, but also to be able to apply them in different contexts and adapt them to different audiences and their needs (Lorke, Golumbic, Ramjan, & Atias, 2019; Roche et al., 2020). For this purpose, knowledge and skills must be developed into competences applicable in various situations.

Academic librarians are experienced in communicating and responding to the needs and expectations of researchers as they have already established reliable relationships with their academic community. However, the audience for citizen science is much more diverse and includes both academic community and the general public, which is less familiar to academic librarians. Therefore, it is worth taking advantage of good practices and experiences of public libraries, whose user audience is essentially broad and coincides with potential participants in citizen science (Cigarini, Bonhoure, Vicens, & Perelló, 2022). Cooperation and partnership between academic and public library staff are very important in this field. In addition, effective communication and information transfer to citizen science participants requires experience and practice.

Librarians' skills can be developed in several ways, such as continuous development, conference attendance, mentoring, and peer learning (Rammutloa, 2023). In a formal environment, competences needed in citizen science activities can be developed by including them into educational programs. Meanwhile, citizen science mediators/facilitators and project initiators/developers need competences, usually at a higher level of involvement, enhance their competences in seminars, trainings and in the workplace. Such education comprises various environments of non-formal teaching/learning being outside educational institutions, e.g. in libraries, museums, educational centres, open laboratories, etc. (Roche et al., 2020). Internal training, knowledge transfer, group work, online training, and e-learning materials have a key role in achieving and maintaining the level of competence expected in the workplace (Borbély, 2022). Active teaching methods are mostly emphasised, such as educational workshops, discussions, problem-based learning, etc. Participatory learning is often mentioned, when competences are developed through direct participation in citizen science activities. To increase learner engagement, game elements can also be used (Roche et al., 2020). Learning can take place in both physical and virtual space.

Due to the complexity of citizen science activities, librarians' involvement and active participation and promotion of these activities require additional competences. In order to evaluate the roles of libraries, and the competences required for librarians to perform in citizen science, as well as their educational opportunities, a study is needed.

The purpose of this article is to identify librarians' competences in academic and public libraries where they perform different roles in citizen science. The objectives of this article are as follow: 1) to investigate the role of librarians in citizen science; 2) to identify what competences librarians need to facilitate/support citizen science projects; 3) to determine the competences librarians most need to participate in citizen science activities; 4) to clarify what librarians consider to be the most appropriate ways to develop the missing competences.

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Methods

Focus group discussion, as a qualitative research method, was used to gain a more in-depth understanding of certain issues from a targeted group of individuals (Nyumba, Wilson, Derrick, & Mukherjee, 2018). Focus group interviews allowed to interact with librarians and gain a broad understanding of the topic in a relatively short time. A deductive approach was employed, and the theoretical framework was modified after the focus group interviews.

Two focus group discussions were established in Vilnius, Lithuania on 28th of April 2023. 20 Librarians from two cities, Vilnius and Kaunas, participated in focus group discussions just after the full-day training session on citizen science for librarians. The interviewees were specialists of various levels – library directors, heads of departments, methodologists, librarian researchers, subject librarians, librarians, bibliographers, information managers, 9 of them were from academic libraries and 11 from public libraries. In order to assess the differences between public and academic librarians' need for citizen science competences and what they consider to be the most appropriate ways of developing such competences, two groups of librarians were formed according to the type of library. All participants gave a written informed consent to take part in the study. The focus group discussions of both groups were held simultaneously in separate rooms and lasted for about 1.5 hour. Each focus group session was conducted by one moderator and one observer, who was taking notes on the interviewees' reactions and responses. The interview guide consisted of open-ended questions. The question examples include: What competences do librarians need to perform different roles in citizen science?; What competences do librarians already have to participate in citizen science projects?; What competences do librarians need to develop when participating in citizen science projects?; How could librarians develop the missing competences needed for citizen science activities?

The interviews were audio-recorded and transcribed after the interview. All the data was processed according to the research integrity procedures for maintaining information security, and all participants were given pseudonyms to protect anonymity. The data from the focus group interviews were processed using qualitative content analysis. Content analysis allowed a systematic analysis of the data, categorising the information to discover patterns that cannot be detected by listening to the recordings alone (Nyumba, Wilson, Derrick, & Mukherjee, 2018). The analysis process consisted of the following steps: (1) Transcripts were read several times. (2) Thoughts and comments expressed during discussions were identified and grouped according to the categories. The main points from each data set were classified and placed under the appropriate category heading. (3) Common features and recurring patterns have been identified so that emergent themes can be developed.

Results and Discussions

The participants of the focused discussion emphasised the influence of their previous experience, the recent duties and work activities when evaluating the possible roles of librarians in citizen science projects. When assessing their personal capacity to participate in citizen science projects, the participants in both groups agreed on the role of a participant or a volunteer, mentioning the lack of experience and understanding of citizen science as the reason. Most of the participants perceive the potential of their participation in a citizen science project at individual level in the role of a project volunteer. Not only is it often based on a limited understanding of citizen science and lack of practical experience, but also on a lack of self-confidence. Librarians in both groups shared the same perception of their involvement in projects and highlighted that personal interest is an essential prerequisite for participation in citizen science projects. Academic

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librarians related motivation more to financial benefits or professional development, although personal interest was also mentioned. In comparison, public librarians' motivation for engaging in citizen science activities was primarily related to the satisfaction of personal needs, self-fulfilment, and the perception of societal benefits.

Regarding the roles of libraries in citizen science, the two groups were almost indistinguishable: both academic and public library staff identified the role of a facilitator as the most appropriate one. Also, the representatives of both academic and public libraries noted that performing the role of a facilitator in citizen science requires both support and incentives from the institution and the leader.

The participants highlighted the influence of personal attributes limiting their possibilities to act as facilitators. The participant saw his/her potential as a facilitator only in certain activities that he/she was comfortable with. Some respondents identified that the ability to fulfil this role depends heavily on the type of library and on existing skills and emphasised that academic librarians are best suited for the role of a citizen science facilitator. The participants highlighted organisational and communication activities that librarians could carry out, such as organising training or other events, disseminating information, engaging citizens or simply providing spaces, and stressed the importance of teamwork for effective librarians' performance in the role of a facilitator of a citizen science project. The representatives from public libraries mentioned that libraries could also undertake project initiation activities. However, librarians from both public libraries and academic libraries, noted that they lack various competences, especially scientific ones, and self-confidence in performing this role.

It is also very important to highlight that the participants of the discussions accentuated that both the roles of a facilitator and an initiator in citizen science projects require the participation and encouragement of institutions. Appropriate financial and human resources must be allocated for this.

Table 1

The role of librarians in citizen science projects

Categories	***Example***
Librarian as a participant	*When you don't have any experience, the role should be the simplest, <...> the collector of some data, <...> well, just the person who does it.(A)*
	I have little experience in this area, limited knowledge, so as a <…> participant in a citizens' project, I would mostly see myself as a participant (A)
	I wouldn't see myself in the role of a facilitator then, just because <...> it's too much of a challenge for me to work with public communication. <...> I could be a data analyst (A)
	It could be some kind of participation in environmental projects (P)
Librarian as a facilitator	*I think librarians are really facilitators(A)*
	…we would do a really good administrative role, a facilitator role (A)
	The facilitator is the most relevant to the librarian's competences ... (P)
	Perhaps a library, libraries could actually play the role of [facilitator] between the researcher and the citizens(A)
	... we can participate at all levels. Each according to his or her own will, according to his or her involvement… (P)
Librarian as an initiator/implementer	*Once you have some more skills, you can start processing the data and managing the project (A)*
	I suppose you can be an organizer if you do some research relevant to the library (A)

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	I think that the library has a lot of potential in the development of citizen science and the organisation of projects. And being not only a facilitator but also the initiator and implementer of such projects. (P)
	… people see a problem and decide to solve it themselves, and then they invoke science, which is where librarians could help formulate it. (P)

*Responses of academic librarians marked as (A), public - (P)

The participants in both groups were also unable to identify specific competences required for the role of a participant or a volunteer in citizen science projects, as they argued that the skills and competences needed by participants are directly related to the specificity of a particular citizen science project.

When discussing the competences needed by librarians to play the role of a facilitator in citizen science, both public and academic librarians distinguished the same competences: organisational, communicational, educational, public speaking / knowledge transfer skills, information and digital literacy as well as more specific skills to research – analytical skills, scientific literacy. The representatives of public libraries emphasised the need for good knowledge of foreign languages. Both groups pointed the greatest importance of organisational competence, as well as communicational competence in the role of a citizen science facilitator. The discussion participants pointed that effective communication requires the necessity to know the audience, to be able to manage it and to present information in a way that is understandable and acceptable to it. As for training, not only are public speaking, audience management and didactic skills needed, but also at least minimal knowledge of the scientific field, an understanding of the basic scientific process are requisite. When discussing the competences needed by citizen science facilitators in data management, the participants agreed that librarians are the professionals most knowledgeable about data collection and management, with years of experience working with specialised systems, data collection, and metadata creation.

When considering the competences imperative for the role of an initiator or implementer of citizen science projects, the discussion participants noted that in addition to the previously mentioned competences, they need the knowledge of the scientific discipline, project writing and management competence, team management and financial literacy competence.

Table 2

Librarians' identified competences needed to engage in citizen science

Competence / skills	**Example**
Organisational competence	*<...> is your goal just to organize something and you have to coordinate the activities of several partners, this is your organizational skills <...> (A)* *<…> you have to organize events (A)* *... if those librarians are the initiators, then <...> they should have leadership qualities ... (P)*
Communicational competence	*… ability to communicate with the audience … (A)* *<...> if the facilitator realizes that communication must be different and knows how to communicate, then he will communicate <…> (A)*
Educational competences	*you need to be both a communicator and a trainer (A)* *... psychological knowledge is required, how to manage the audience, how to communicate with the audience <...>, how to structure the training material and present it ... (P)* *... you have to focus on the audience, what you want to say and precisely to this audience. <…> it is important that people understand your message…(P)*

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	... to present knowledge, to explain there ... (P)
Public speaking / Knowledge transfer skills	*... Also rhetorical skills, knowledge of public speaking ...(P)* *... for conducting training, first of all, a person must be able to speak, he must have those oratorical abilities to have ...(P)* *…the scientist must adapt those studies in a way that the citizens of the general public can understand … (A)*
Project writing and management skills	*… you need to be both a financier and know how to write projects …(A)* *... I associate the initiator with <...> social management, with project management, and already, I would say, with such deeper knowledge and experience. (P)* *…think that here <...> more administrative skills, here you need to know how to manage a project, manage a team...(P)*
Information literacy	*...search in various e-resources, starting with databases <...>literature knowledge...(P)* *In the second stage, <...> is the management of competence information...(P)* *...of course, information literacy...(P)* *… it is that knowledge of the library system, and the understanding of those information resources, what we have, what we manage, how we can spread it… (P)*
Digital literacy	*the librarian must provide that app, bring the app together with the citizens (A)* *…it is very important to know information technology, IT (P)*
Specific knowledge of a scientific field or discipline	*… you cannot be an organizer, an initiator, because you do not have enough of this scientific knowledge … (A)*
Team management competence	*… it is very, very important to have a team here, to work in a team … (A)* *... the ability to create a team, involve other participants, enable them to act ...(P)*
Financial literacy	*… it is important to have an understanding how to plan and manage project funding…(P)* *… you need to be both a financier and know how to write projects …*(A)
Scientific literacy	*…in order to raise some kind of idea, problem, a bit of scientific thinking would be needed here (P)* *…it is important to know at least something in a certain field, <...> to be interested in that certain field, because after all, we are talking about science ... (P)*
Data management	*…librarians need to help manage research data; we already have data stewards in the library…(A)*

*Responses of academic librarians marked as (A), public as (P)

The respondents of both groups emphasised the nature of citizen science projects, as well as the characteristics of the project participants, as another essential factor determining the diversity of competences needed by librarians in citizen science projects. The participants highlighted that the success of librarians in facilitating citizen science projects depends on the audience the library reaches (academic community, general public, children). Librarians of academic libraries admitted that the community served by the academic library is quite strictly defined, not all groups of society are easily accessible, therefore, in their opinion, the implementation of some citizen science projects would be difficult. Academic librarians also mentioned that by collaborating with other institutions (public libraries, schools, etc.), they could contact populations that are outside the reach of their community (children, seniors). Meanwhile, public librarians, who have very strong relationships with the public, lack dialogue and collaboration with researchers.

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The librarians from both groups also mentioned the difference between individual and collective competences that the library has as an organisation. The participants acknowledged that probably no single librarian has all the competences to implement citizen science projects individually. Citizen science projects can leverage the expertise of different members of the library team for complex tasks.

When discussing the competences already possessed by librarians, the opinions of academic and public library librarians differed. Librarians of academic libraries, even those who had no experience of participating in citizen science projects, suppose that they already have the essential competences required for the role of a citizen science facilitator, they just need to be able to apply them in new activities of citizen science projects. In this group, the prevailing opinion was that academic librarians have high competences, especially communicative ones when it comes to preparing and disseminating information. While developing their thoughts on communication, the participants mentioned the importance of adapting information and communication to different audiences.

Table 3

Citizen science competences possessed by librarians

Competences	**Example**
Organisational competence	*... we have management skills, at different levels, <...> we are also organised... (P)* *... I can organise the infrastructure, I can provide rooms for the meetings, I can provide coffee and refreshments, that's my area ...(A)* *... how to involve, interest people so that they participate in activities ... (P)* *... organizes events, all kinds of activities ... (P)* *… to find volunteers <...> I, for one, would certainly find volunteers to get involved. (A)*
Communicational competence	*We have the following competences: communication ...(P)* *... we have communication skills ... (P)* *...he has the competences to communicate with all groups (...) (A)* *Subject communication is no better. communication, <…> information dissemination, … (A)* *... those competences <...> community building, community inclusion, all that we do… (A)* *… according to the different groups <...> how to communicate…(P)* *Well, it's just that libraries already have the dissemination function... (A)*
Educational competence	*…how to train different groups… (P)* *My competence is to provide training. (A)* *We have all the competences to organise events, to deliver training and to analyse data (A)*
Information literacy	*We all have really, really strong information and information systems retrieval competences...(P)* *We know how to find the answer among a lot of data... (P)* *… has competence in information retrieval... (A)*
Digital literacy	*... about library systems, which, among other things, are among the most complex systems. <...> librarians are used to those systems. (P)* *Computer literacy… (A)*
Analytical skills	*Librarians are used to those systems, and how to put data into them, how, what to get ... (P)* *…data gathering, data analysis,…(A)*

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Scientific literacy	*We have the basics of scientific work, understanding... (P)* *Librarians are professionals in data management, collection ... (P)* *... it's various competences, we have a methodology department there, <...> some kind of data collection ...(P)* *… those competences <...> data management, <...> all of which we are doing… (A)* *We have all the competences to organise events, to deliver training and to analyse data (A)* *… to assist with data management, … (A)*

*Responses of academic librarians marked as (A), public as (P)

When asked about the possibility of acquiring the knowledge and competences necessary for citizen science activities, the discussion participants believe that they can develop the missing knowledge, abilities or competences to perform a specific role in citizen science projects. During the discussion, it was found that librarians lack organisational, project writing and management competences, skills in financial literacy, scientific literacy and the knowledge of scientific disciplines. The need to develop public speaking and educational competences was also indicated.

Participants in both groups acknowledged a lack of general knowledge of citizen science, which leads to challenges in adapting existing competences to citizen science projects and a motivation deficiency to engage in citizen science activities. The discussion participants emphasised the importance of motivation in developing the citizen science competencies. In their opinion, to encourage the librarian involvement in citizen science projects and the development of the competences they need, it is critical for librarians to understand the meaning of the activities they perform and the need for those competences. The participants indicated that both external motivation (financial support, recognition of acquired competences in the institution, the possibility of applying them in practice, career opportunities) and internal motivation (curiosity, self-expression, understanding of the meaning of activities) are crucial. The librarians who participated in the discussion expressed the opinion that the lack of time and the fact that citizen science and related activities are not included in their job responsibilities limit librarians' engagement in citizen science and the development of their scientific and other competences related to citizen science.

When talking about the best way to acquire the missing competences, librarians believe that the best ways to acquire citizen science competences are participating in citizen science projects, engaging in citizen science communities, learning from experience, attending discussions with more experienced citizen science participants, and learning from peers. Both groups also emphasised the importance of self-paced learning.

Table 4

Librarians training priorities to acquire citizen science competences

Competence development way	**Example**
Training	*Contact training <...> this kind of training and participation in projects is most important. (P)* *... Training is the ideal way, especially when it's live and not virtual, when it's open to discussion, when it's with people who have the experience again, and then you find out for yourself what you are missing. (A)*
Educational projects / events	*... I agree that there is a need for a wide range of projects, both locally and internationally, in which one can participate, even if it is the same work placement ... (P)*

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	... there are a lot of good international conferences, <...> it's about attending as many events as possible ... (A)
Learning by participating in citizen science project	*... To get involved, perhaps, in some projects that are already underway. (P)* *First of all, maybe as a participant, to see the project from the inside... (A)* *<...> for other competences, yes, to participate in projects ... (P)* *First acquired in the theoretical way, and then, in a less significant role, acquired in practice. (A)*
Sharing good practices	*And I'm thinking, maybe we should set up more citizen science communities and expand them. <...> to invite them, to publicise their activities <...> All the best ideas and thoughts, it seems to me, only come from collaboration and talking to each other. (P)* *... it is important to collaborate, to learn from colleagues ...(P)* *...to observe how others are doing...(P)* *Finding people to collaborate with and get good practice from...(A)*
Self-paced learning	*...reading, it can be more passive...(P)* *...to go deeper into an area, a particular area of perhaps science or research that you find interesting... (P)* *Training, and learning the theory on your own (A)* *...there is training going on, we came to the training, <...> Next, I would then have to review, let's say, the training, the training material, so that I can go deeper, to further develop that knowledge ... (A)*

*Responses of academic librarians marked as (A), public as (P)

When asked to name specific learning activities, the participants highly prioritise training as the most relevant way to their needs. During training, they pointed the employment of active education/learning methods when not only theoretical knowledge is acquired but also practical tasks and discussions are performed, which allow the practical application of the knowledge. Both groups mentioned the value of individual learning online. They emphasised the necessity for enhancing the theoretical knowledge before training by reviewing the training material prepared in advance.

To summarise the results of the study, the perception of citizen science in academic and public libraries differs due to different attitudes depending on the specificities of the community served, but there is a general overlap in the perception of the most appropriate role of librarians as a facilitator, of the competences and skills needed to fulfil this role, and of the most appropriate ways to develop these competences.

Conclusions

Librarians acknowledge that in citizen science projects they can take on different roles: participants, facilitators or initiators/implementers. However, librarians generally consider themselves as playing an important role in promoting citizen science by facilitating community engagement, fostering connections and providing important resources that enrich the research process and community participation. Librarians' roles as facilitators and initiators/implementers relate to the involvement of the library as an institution in citizen science projects. By allocating material, financial and human resources, the library creates motivational conditions for the involvement of librarians in citizen science projects.

Competences needed by librarians when participating in citizen science projects contain competences that librarians already have and use in everyday library activities: organisational, communicational, educational competences, knowledge sharing, public speaking, information and

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digital literacy, analytical skills and more. Initiating and implementing citizen science projects also require project writing and management skills, financial literacy, scientific competence and knowledge of a specific scientific field.

Librarians, comparing the competences required for citizen science projects with the ones librarians already have, are convinced that they already have most of the necessary competences and abilities, and apply them in their daily activities; it is only necessary to be able to apply existing competences to new areas. Librarians of both academic and public libraries recognised a lack of knowledge and understanding of citizen science concepts, which leads to challenges in applying existing skills in citizen science projects. They also lack the motivation to engage in citizen science activities, as these are additional activities to their regular work responsibilities.

Librarians prioritise learning from their own and their colleagues' experiences, gaining knowledge by participating in citizen science projects, engaging in citizen science communities, and participating in discussions with more experienced citizen science participants and peers. Training and self-paced online learning are also relevant options for developing the needed competences.

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Компетентності бібліотекарів у виконанні різних ролей у проєктах громадянської науки

Мета. Мета цієї статті – представити компетентності бібліотекарів у виконанні різних ролей у діяльності, пов'язаній з громадянською наукою. **Методика.** Було організовано фокус-групові дискусії, щоб з'ясувати, яку роль бібліотекарі можуть виконувати в проєктах громадянської науки і які компетентності необхідні для таких проєктів. У фокус-груповій дискусії взяли участь бібліотекарі з академічних та публічних бібліотек. **Результати.** Результати групової дискусії показали, що бібліотеки здебільшого розглядаються як посередники громадянської науки, які організовують і забезпечують комунікацію та поширення інформації, організовують і проводять навчання та координують інші види діяльності. **Висновки.** Бібліотекарям потрібні організаційні, комунікаційні, освітні навички, навички публічних виступів / передачі знань, інформаційна та цифрова грамотність, аналітичні навички, а також більш специфічні навички для проведення досліджень. Ініціюючи проєкти, бібліотекарі також потребують знань наукової дисципліни, навичок написання проєктів, управління командою та фінансової грамотності. Бібліотекарі вже володіють певними компетентностями, але їх необхідно постійно оновлювати, а також здобувати нові. Найкращий спосіб отримати необхідні компетентності – брати участь у проєктах громадянської науки, навчатися на практиці або в колег.

Ключові слова: громадянська наука; роль бібліотеки; компетентності бібліотекарів; розвиток компетентностей

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