Scientific Literacy Education Outside the Classroom: A Study in Acquisition of Knowledge and Skills About Science in Public Libraries in Croatia

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Abstract. The importance of science to the future of society is likely to increase as it will offer solutions to many problems society is confronting today. To become fluent in matters of science, one needs to participate in some type of science education. Education in science usually is related to the formal education institutions. The outcome of science education is science literacy, the capacity to understand and apply scientific knowledge in personal and professional life. Science can be also taught outside classrooms in many places including public libraries. The results of the research study presented in this paper show that public libraries in Croatia organize versatile science related activities which attract library user of all ages. Public libraries lack resources to be able to achieve even better results from those presently achieved. They also need a greater recognition for their role in science learning.

Keywords: Science learning · Scientific literacy · Public libraries · Education outside the classroom · Croatia

1 Introduction

Schools and universities have been places of learning on scientific concepts, principles, theories, and models about the world we live in for centuries. Such knowledge is the prerequisite for appropriately coping in a modern world [1]. As the world progresses, knowledge and skills acquired during from formal education are not enough because the changes in society are happening perpetually and demand new approaches to solving problems from knowledgeable citizens. In addition to schools and universities, libraries are also places of learning. The concentration of the written knowledge in libraries and the quality of library services and premises have enabled generations of learners of all ages to enter the realm of knowledge during and after their formal education enabling continuous learning. This is the reason why public libraries are major importance to the general population seeking answers to questions related to different aspects of their lives. Public libraries are popular places for the presentation of versatile scientific achievements because they attract many different and motivated people, both regular library users and occasional library visitors. In addition to being a

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popular place, public libraries have a special role in society. They are open to anyone, regardless of their age, gender, education level, opinion, and affiliation. In the case of education outside the classroom, public libraries are "non-partisan, trusted and accessible community gathering places where people of all ages come to explore and share ideas in an informal educational setting" [2]. To succeed in presenting science related content, public libraries cooperate with individual scientists and scientific institutions to acquire new information about the latest scientific discoveries and also to acquire new knowledge for themselves [3]. The latter is important as "librarians don't always have all the skills needed in order to satisfy the digital learning needs of all groups, but they have the ability to connect people" [4]. The lack of knowledge is just one of several areas in which public libraries need additional support. Other areas include better financing, more employees (librarians) and certainly more library space. In spite of these problems, public libraries are important to their communities which expect new services including those related to the latest scientific discoveries.

2 Science Education in a Changing Environment

The global (formal) system of education is finding itself in the most difficult times. Everything around it is changing and these changes are happening very rapidly. "We don't even know what skills may be needed in the years ahead. That is why we must train our young people in the fundamental fields of knowledge, and equip them to understand and cope with change. That is why we must give them the critical qualities of mind and durable qualities of character that will serve them in circumstances we cannot now even predict" [5]. Yet, the duty of the formal education institutions is to educate individuals and equip them with knowledge and skills which will enable them to become employed, and to advance their knowledge and skills throughout their life. As the focus of this paper is on science education outside the classroom, the attention will be given to public libraries that can provide science related knowledge and skills in areas of interest to the wide public. Although the understanding of science education should be straightforward, there are different views of it. The outcome of science education should be a scientifically literate person. OECD (Organisation for Economic Cooperation and Development) [6] suggested that scientifically literate persons (students) should be able to: explain phenomena scientifically; evaluate and design scientific enquiry and interpret data and evidence scientifically. However, authors like Lee and Roth [1, p. 33] indicated that science educators should not be interested only in the appearance of science literacy and should be interested in "understanding and theorizing ways of participating in science and scientific literacy that do not have boundaries coincident with formal education and life thereafter" and that "ideas of science and scientific literacy that dominate the current literature in science education ought to be imposed on what and how people should know about science once they have left formal education". This why librarians could have more important role in post-formal education taking place in public libraries.

3 Education Outside the Classroom

Education outside the classroom can be defined as "the use of places other than the classroom for teaching and learning" [7]. More broadly, it is "any structured learning experience that takes place beyond the classroom environment during the school day, after school or during the holidays. It can include, amongst other activities, cultural trips, science and geography fieldwork, environmental and countryside education, outdoor and adventurous group activities, learning through outdoor play, and visits to museums and heritage sites" [8, p. i]. Education outside the classroom comprises of three domains [9]: knowledge, attitude and skill. These three domains have the following objectives: "first, to reinforce student understanding of concepts taught in class; second, to provide learning experiences in real-life situations; third, to make learning more meaningful and enjoyable; fourth, to enable students to think and master knowledge though contextualised experiences; fifth, to increase student interest and attitudes to learn; sixth, to expand teamwork and social skills; seventh, to develop skills in the collection, processing and analysis of data and information; and eighth, to cultivate wholesome values among the students themselves" [9, pp. 12–13]. While these clarifications are oriented towards students, education outside the classroom should not necessarily be oriented exclusively on school and university students but also to adults seeking additional education after the completion of formal education. To become more successful in this area, public libraries need partnership and cooperation with the academic community to transform learning into active learning experiences and help students (and other interested individuals) become civically-engaged citizens [10]. The most important point is that education becomes available to everyone with various educational background interested in topics of science in order to become scientifically literate or to advance the acquired literacy. This is where public library comes in.

4 Research Methodology

Scientific literacy is an on-going hot topic which is of interest to all educational institutions. While education in scientific topics is usually related to formal education, other institutions like public libraries are also sometimes included in teaching about science in form of lectures, public presentations of results of scientific discovery, workshops, quizzes and other similar activities. Not much is known about the participation of public libraries in this kind of activities. This was the main motive for carrying out the research with aim to find out the rate of public libraries' participation in activities related to science. The purpose of the research study in this paper was to find out whether public libraries have been active participant in acquisition of scientific literacy [11]. The main hypothesis of the paper is that public libraries (in addition to academic and other institutions in society) carry out a science related activities using all the available resources. The results of the research would help in further popularization of public libraries as places of acquisition of science related knowledge and skills. Online questionnaire with 16 closed type questions was chosen as the principal research method. The data were then analyzed by use of descriptive statistics.

The invitation for participation in the research study was sent to public libraries in Croatia information about which were found at the Portal of libraries in Croatia at http://www.knjiznica.hr. According to the Statistical yearbook of the Republic of Croatia for 2016 [12], in 2013 (the latest available data) there were 269 public libraries in Croatia. However, 219 libraries were listed at the Portal of libraries in Croatia with their official e-mails. 204 mails were delivered without errors on May 7th 2018 with the closing date for participation on May 18th 2018. The total of 95 answer sets collected, which is 35.31% of all public libraries listed in the Statistical yearbook of 2016 and 46. 56% of all the invitations successfully delivered for participation in the research study.

5 Research Findings and Comments

The next section of the paper presents results from the research study in public libraries about carrying out science related activities. The results of questions 3 and 4, and 13, 14, 15 and 16 were presented cumulatively because of the limited space.

5.1 Familiarity with the Term – Scientific Literacy (N = 94)

The term scientific literacy is well known in the sector of education. There are many definitions of scientific literacy and each one developed in time as the technology and society progressed. In this research, public libraries were asked a simple question – were they familiar with the term scientific literacy? 89.1% (N = 82) public libraries were familiar with the term scientific literacy and 10.9% (N = 10) were not familiar with that term. The success of science related activities depends on defining a clear purpose of science related activities and involvement of public libraries and librarians in activities that would result in betterment of society. The segment of adult learning (the interest of adults for science related activities was demonstrated in the previous question) could be further developed, but currently it lacks systematic support in Croatia.

5.2 Number of Librarians Involved in Science Related Activities (N = 94)

As any other library resource, human resources vary greatly from one public library to another, from a single librarian public library (small city public library) to libraries employing several hundred librarians (like Zagreb City Libraries – system with over 40 individual public libraries; in this research they were counted as a single participant). Real life capabilities of public libraries dictate the successful organization of the science related activities. Almost half of the public libraries that participated in this research (46.8% N = 44) had only one person participating in science related activities. 30.9% (N = 29) public libraries had 2–3 librarians, 6.4% (N = 6) public libraries had 4–5 librarians, 6.4% (N = 6) public libraries had more than 5 librarians participating in science related activities. 9.6% (N = 9) public libraries did not participate in science related activities, so they did not dedicate any librarian for this kind of activities.

5.3 Frequency and Types of Science Related Activities Taking Place in Public Libraries (Multiple Answers) (N = 94)

This section presents the results of two questions. One question is related to the frequency of science related activities in the library. It is a strong, but not the only indicator of representation of scientific activities in public libraries. Library holdings containing science information resources are often accompanied by services tailored for different library user groups. Science related activities could be of great interest to the widest public instead of being delivered only to limited groups of participant at universities. The second question is related to types of science related activities taking place in public libraries.

Public libraries participating in this research organized science related activities with different frequency, depending on the available resources. They operate in very different conditions and their resources differ resulting in differences in frequency of organizing science related activities. Public libraries organize science related activities

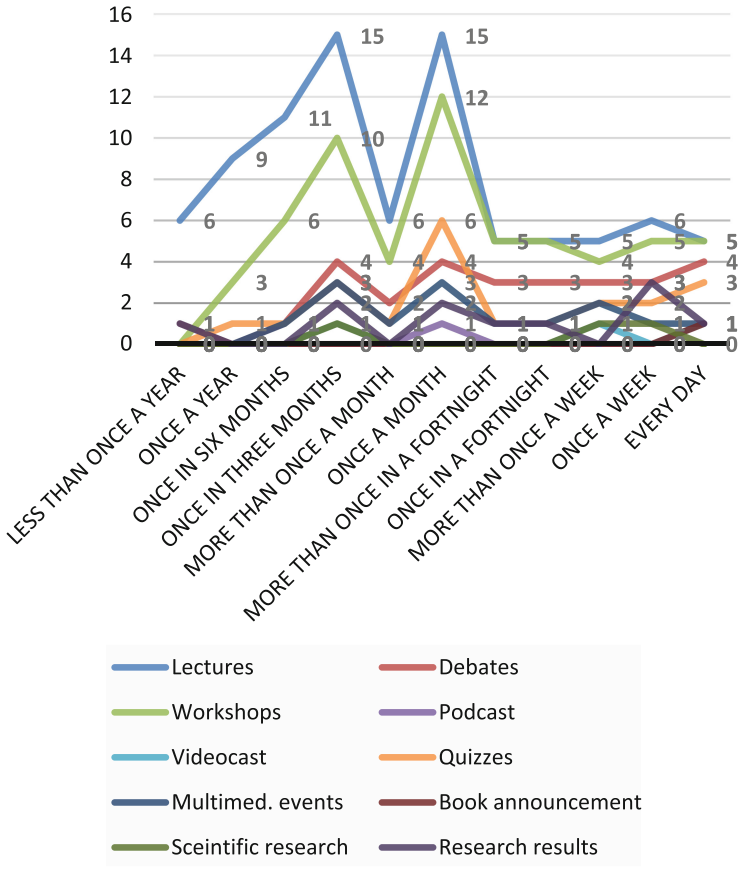

Fig. 1. Frequency and types of science related activities in libraries

on a regular basis, regardless of the type of activity. Most frequently organized activities were lectures, workshops and quizzes. The majority of libraries organized such activities once a month, one in three months or once in six months and very few libraries organized such activities several times a month.

5.4 Library User Categories Demonstrating the Greatest Interest for Science Related Content/Activities in Public Libraries (N = 94)

Public libraries are by definition open to the widest possible range of user categories. Some of them are located near residential areas, schools, universities, major urban traffic points and in centers of cities. As such, they attract many different people by offering versatile services. In this question, the focus was on public library user categories who demonstrated the greatest interest in science related content/activities in the library. The Fig. 1 shows that elementary school students demonstrated the greatest interest in science related content/activities in public libraries. They are followed by university students and high school students but also by adults having different aims when participating in such library activities. We see it is possible that there is a lack of such content for the adult population and that the lifelong learning is not developed (Fig. 2).

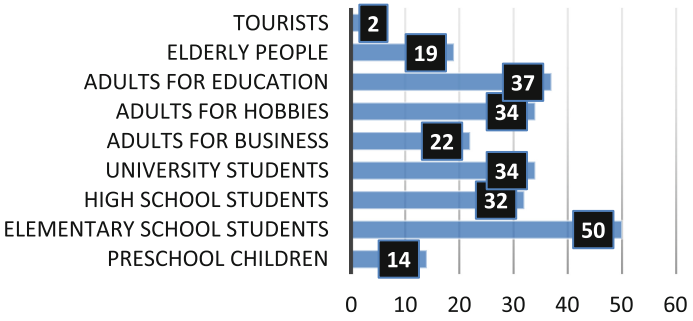

Fig. 2. Public library user categories showing the greatest interest for scientific content/activities in the library

5.5 Resources Needed in Order to Improve Science Related Activities in Public Library (N = 94)

There is probably no public library that has ideal conditions for carrying out its daily activities, especially in countries in which public libraries are closed due to lack of financial resources. In Croatia public libraries are not closing, at least not frequently as in the UK or USA [13], however, they would certainly benefit from improved conditions for their operation. As this research has its focus on science related activities, this question aimed at exploring areas in which public libraries could improve their conditions for carrying out science related activities (Table 1).

Table 1. Resources needed in public libraries in order to improve science related activities

	N	%
More financial resources	67	71.3
More employees	67	71.3
Additional education for librarians wishing to participate in science related activities	49	52.1
More library space	48	51.1
Employees with specific knowledge of certain areas of science	40	42.6
Better IT equipment	35	37.2
Better AV equipment	22	23.4
More science related titles in library holdings	15	16

The results indicate the pressing areas in which librarians feel lack of concrete resources to achieve higher quality in providing science related activities. The first two places indicate limited public library resources limiting the scope and duration of science related activities in public libraries. In addition, half of librarians indicated that they needed additional education to participate in science related activities.

5.6 Frequency of Public Library Users Contacting the Library Asking for Science Related Titles (N = 93)

The respondents could provide answers on scale from 1 (never) to 5 (every day): 2.2% (N = 2) chose value 1, 19.4% (N = 18) chose value 2, 48.4% (N = 45) chose value 3, 14% (N = 13) chose value 4 and 16.1% (N = 15) chose value 5. The approximation librarians made in this question shows that library users seek science related titles from time to time. Since public libraries offer library material of different genres and are not primarily focused on scientific literature, the results indicate stable but not frequent need for this type of library material.

5.7 Frequency of Public Library Users Contacting the Library Asking to Participate in Science Related Activities in the Library (N = 93)

While public library users demonstrated occasional interest in science related library material, they were less interested in participation in science related activities in the library. The respondents could provide their estimation (however, more concrete statistical data would be required for more detailed analysis) answers on scale from 1 (never) to 5 (every day): 9.9% (N = 9) chose value 1, 28% (N = 26) chose value 2, 48.4% (N = 45) chose value 3, 11.8% (N = 11) chose value 4 and 2.2% (N = 2) chose value 5. The results are satisfactory as public libraries offer many versatile activities in their premises and science related activities are just one such activity category.

5.8 Frequency of Cooperation with Members of the Academic Community When Preparing Science Related Activities in the Library (N = 94)

Cooperation with members of the academic community in different areas of public library operation can be very productive for both sides: scientific research, education of librarians, and promotion of results of scientific research. The librarians were given an opportunity to estimate the frequency of cooperation with the academic community. The respondents could provide answers on scale from 1 (never) to 5 (every day): 10.6% (N = 10) didn't cooperate with academic community at all, 29.8% (N = 28) did it very infrequently, 34% (N = 32) did it from time to time, 18.1% (N = 17) frequently and 7.4% (N = 7) did it every day. While it is hard to expect that public libraries will have developed relationships with the academic community needed for cooperation on a daily basis, non-existent and very infrequent cooperation was unexpected.

5.9 Satisfaction with Cooperation of Public Libraries with Members of the Academic Community in Joint Preparation of Science Related Activities in the Library (N = 92)

The respondents were given a scale from 1 – totally dissatisfied, 3 – nor satisfied, nor dissatisfied, 5 – totally satisfied: 5.4% (N = 5) chose value 1, 15.2% (N = 14) chose value 2, 47.8% (N = 44) chose value 3, 20.7% (N = 19) chose value 4 and 10.9% (N = 10) chose value 5. The results show that half of the respondents were not satisfied nor dissatisfied with the existing cooperation. The distribution of the rest of answers is more or less even. There is most certainly space for improvement in the cooperation which could be intensified. The next question will show why this is the case (Table 2).

5.10 Importance of Public Libraries as Places for Learning About Science (N = 94)

The respondents were given a scale from 1 – totally unimportant, 3 – nor important, nor unimportant, 5 – totally important: values 1 and 2 were not chosen. 9.6% (N = 9) chose value 3 while 45.7% (N = 43) chose 4 and 44.7% (N = 42) chose value 5. Public libraries are important places for learning about science. Due to the lack of resources, cooperation with academic community would help them to overcome some shortages and achieve better results in learning about science.

5.11 Opinions of Public Libraries About Their Role in Learning About Science (N = 94)

The respondents were given a scale from 1 – totally disagree, 3 – do not agree nor disagree, 5 – totally agree.

The results in four final questions in the questionnaire suggest significant interest of public libraries for participation in science related activities. The learning about science does not ceases with the completion of formal education and librarians need more science related education to perform science related activities. All the answers clearly show significant interest of public libraries for participation in science related activities.

Table 2. Opinions of public libraries about their role in learning about science

	1	2	3	4	5
Librarians should participate more in science related activities in their libraries	1	2	14	36	41
Public libraries should promote more their science related activities	1	1	16	32	44
Learning is a lifelong activity, formal education is not enough to keep up with novelties in science	0	0	11	12	71
Public librarians need more education about science to perform their science related activities	3	1	15	28	47

6 Conclusion

Learning about science can take different forms and can take place in many different locations. Today, the formal education institutions are not the only locations in which students and adults can acquire knowledge. Public libraries, museums, open spaces are all taking part in this endeavor. Public libraries in Croatia have accepted participation in carrying out science related activities as part of their programs attracting great interest from library users of difference generations from students at all levels of education to adults, thus confirming the hypothesis of the research study. In spite of their enthusiasm which can be seen from the frequency and types of science related activities carried out in their premises, public libraries need additional resources, education for librarians and recognition for their job related to science learning. The results in this research indicate that there are additional opportunities for improvement of conditions in public libraries especially in partnership with academic community. Such collaboration can offer additional education for librarians, joint participation in scientific research, presentation of research results, and publishing of science related material that can be used in science related activities for the purpose of popularization of science. Public libraries have proven to be a very valuable partner in society and this position of public libraries should be used more frequently and more intensively for the betterment of society.

References

1. Roth, W.-M., Lee, S.: Scientific literacy as collective praxis. Public Underst. Sci. **11**, 33–56 (2002)
2. Cornerstones of Science. https://www.cornerstonesofscience.org/why-we-do-it/why-libraries/
3. Eppur Si Muove. http://www.kgz.hr/hr/novosti/eppur-si-muove/24015
4. Nygren, Å. The Public Library as a Community Hub for Connected Learning. http://library.ifla.org/1014/1/167-nygren-en.pdf
5. Gardner, J.: Education and Excellence. http://www.pbs.org/johngardner/chapters/3.html
6. OECD: PISA 2015 Draft Science Framework (2015). http://www.oecd.org/pisa/pisaproducts/pisa2015draftframeworks.htm
7. Learning Outside the Classroom MANIFESTO. http://www.lotc.org.uk/wp-content/uploads/2011/03/G1.-LOtC-Manifesto.pdf

8. Kendall, S., Murfield, J., Dillon, J., Wilkin, A.: Education Outside the Classroom: Research to Identify What Training is Offered by Initial Teacher Training Institutions. National Foundation for Educational Research (2006)
9. Wan Sulaiman, W.I., Mahbob, M.H., Azlan, A.A.: Learning outside the classroom: effects on student concentration and interest. Procedia Soc. Behav. Sci. **18**, 12–17 (2011)
10. Yates, F.: Beyond library space and place: creating a culture of community engagement through library partnerships. Indiana Libr. **33**, 53–57 (2014)
11. Vrana, R.: Promotion of scientific literacy and popularization of science with support of libraries and internet services. In: Kurbanoğlu, S., Grassian, E., Mizrachi, D., Catts, R., Špiranec, S. (eds.) ECIL 2013. CCIS, vol. 397, pp. 324–330. Springer, Cham (2013). https://doi.org/10.1007/978-3-319-03919-0_42
12. Statistical Yearbook of the Republic of Croatia. http://www.dzs.hr/Hrv_Eng/ljetopis/2016/sljh2016.pdf
13. Cuculić, K.: Sve manje biblioteka: Zatvaranje knjižnica poput spaljivanja knjiga. Novi List (2013). http://www.novilist.hr/Kultura/Knjizevnost/Sve-manje-biblioteka-Zatvaranje-knjiznica-poput-spaljivanja-knjiga