



## NON-FORMAL SCIENCE EDUCATION IN CRACOW: BENEFICIARIES

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### Abstract

*Non-formal science education is a significant part (component) of general education which includes different educational activities carried on outside the framework of the formal system, to provide selected types of learning to particular sub-groups of the population.*

*The study describes the use of informal education opportunities by the inhabitants of Krakow in Poland. Various possibilities offered by living in an old, historic academic city are described. The level of knowledge of these attractions by the inhabitants and the level of their use were examined. It was examined whether the use of informal education by the inhabitants of Krakow depends on their age, level, and type of education.*

**Keywords:** *descriptive study; general education, non-formal science education, science education*

### Introduction

Informal education is a life-long process of shaping attitudes, values, skills, and knowledge - based on various experiences and the impact of the educational environment (family, friends, work, play, market) and the impact of mass media. Having in mind that our society is facing more and more complex problems that remain to be solved for future generations, all this requires qualitatively new natural science and technological education approaches, for example development of non-formal science education (Lamanauskas, 2017). Non-formal education has been more and more important in the last decades both in Europe and in other countries (Bilbokaite et al., 2018; Marques & de Freitas, 2016; Morgan & Kliucharev, 2011; Oyigbo et al., 2021). The number of scientific publications on this topic is also increasing. In the WoS database, 173 articles were received for the query "science" & "non-formal education", of which 59 were qualified to the Education & Educational Research group. The table below shows a clear increase in interest in this topic since 2015.

**Table 1**

*Number of Articles in Particular Years in WoS Database for the Query "Science" and "Non-Formal Education".*

<input type="checkbox"/> 2023	2	<input type="checkbox"/> 2016	11
<input type="checkbox"/> 2022	15	<input type="checkbox"/> 2015	25
<input type="checkbox"/> 2021	16	<input type="checkbox"/> 2014	8
<input type="checkbox"/> 2020	17	<input type="checkbox"/> 2013	5
<input type="checkbox"/> 2019	16	<input type="checkbox"/> 2012	3
<input type="checkbox"/> 2018	21	<input type="checkbox"/> 2011	4
<input type="checkbox"/> 2017	17	<input type="checkbox"/> 2010	1

Since the objectives of non-formal education are broad and diverse, a large variety of non-formal learning activities are available, it was decided to investigate who and how uses these opportunities for non-formal education that are available in Kraków.

Kraków was the second capital of Poland (from 1320 to 1609), has one of the oldest universities in this part of Europe (the Jagiellonian University was founded on May 12, 1364). currently, Kraków has over 40 universities, many science museums, educational paths... and other opportunities for informal scientific education. There are 781,000 people permanently living in Krakow, plus about 40,000 students.

## Research Methodology

### *Background*

Due to the historical, cultural, and scientific background of Krakow, it was decided to investigate how the inhabitants of Krakow use the opportunities for informal education. The study involved 729 people aged 12 to 84. They were students of the University of Life Sciences in Krakow, their friends, students of the third age university at the University of Life Sciences, people associated with the University of Children and Parents at the University of Life Sciences and children participating in educational projects at the University of Warsaw. It can therefore be assumed that these are people familiar with Krakow and its educational offer.

The research was carried out using a survey questionnaire, which included 12 main questions that checked what non-formal education offer the participants of the study use (YES/NO questions) and 12 extension questions that checked how often they do it. In this case, a 5-point Likert scale was used. The survey was anonymous and participation in the research was voluntary.

### *Study Population*

The study involved 491 women (62%) and 302 men. This is consistent with statistical data, in Poland the percentage of women studying is higher than that of men. The youngest participant in the study was 12 years old and the oldest 84. However, the largest group were young people aged 19 to 29. The largest group were people who had completed secondary school (41.3%), 24% had a bachelor's degree and 18.1% had a master's degree. Only primary education had 9.6% and post-graduate studies 7%. The level of education corresponded to the age of the respondents. The fields of study given by the respondents were classified into four groups: humanities (27%), exact and technical sciences (36.5%), natural sciences (21.3%) and other (15.2%).

### *Description of Activities Available in Krakow*

The research asked about 12 different activities related to informal teaching in the field of natural sciences available in Krakow.

1. The first scientific attraction is the Science and Art Festival. It takes place every May at the Main Market Square in Krakow. The Main Market Square is the largest square in Krakow and the largest medieval market square in Europe (4 ha). All universities in Krakow and many non-formal education institutions have

their tents in the Market Square. There are also performances on stage. All attractions are free.

2. The second attraction is the "open day". Every university, every high school, elementary school or even kindergarten has its "open days". They show the advantages of the facility - but very often it is accompanied by demonstrations of effective natural experiences, interesting workshops for visitors, lectures or even theatre performances. All attractions are free.
3. The third scientific attraction is Małopolska Night of Scientists. It is a popular science event which has been coordinated by the Małopolska Province since 2007. Shows, workshops and laboratory demonstrations, which each year attract an increasing number of viewers. Scientists share their work, experience, and passion, while contributing to the popularization of science and making participants aware of the important role of scientific discoveries. They also present the role of scientists in everyday life and encourage young people to choose a research career. Participants may conduct spectacular experiments on their own, observe and name the laws of physics encountered in everyday life. All attractions are free.
4. The next scientific attraction is the museum night. It is one of the most popular cultural events. The event is about making museums, galleries, cultural institutions, and historic buildings available on a selected day during the night.

That night, the organizers prepare unique attractions, for example, visiting usually inaccessible facilities, concerts, workshops, workshops, and attractions for children, etc. Often the ticket price is symbolic (PLN 1 = EUR 0.25). Krakow has one of the richest museum collections in Central Europe. In Krakow we have among others:

- State Art Collection - Wawel Royal Castle
- The National Museum in Krakow with branches and galleries
- The Historical Museum of the City of Krakow with its branches
- Numerous university museums
- Church Museums
- Museum Branches of the Society of Friends of Fine Arts in Krakow
- Ethnographic museums
- History Museums
- Military museums
- Martyrdom museums
- Technical museums
- Art museums (art museums)
- Biographical museums
- Literature museums
- Specialty Museums
- Eco-museums

We can see these collections are very diverse - everyone should find something interesting.

5. In addition to numerous art and history museums in Krakow we have numerous natural museums, e.g.:
  - Pharmacy Museum
  - Museum of municipal engineering
  - Glass and Ceramics Centre

- Geological Museum of the Institute of Geological Sciences of the Polish Academy of Sciences
- Museum of illusions
- Geological Museum of the University of Mining and Metallurgy (AGH)
- The AGH Museum and the Experimental Mine
- A pharmacy under the Eagle
- Anatomical Museum of Collegium Medicum
- Polish Aviation Museum
- Pharmacy Museum of Collegium Medicum
- The Natural History Museum of the Institute of Systematics and Evolution of Animals of the Polish Academy of Sciences
- Stained glass workshop and museum
- Live Butterfly Museum
- The amber museum
- The Centre for Natural Education of the Jagiellonian University with exhibitions:
  - Astronomy
  - History of life on earth
  - Systematics of animals
  - Biogeography
  - Biomes
  - Protection of the natural environment
  - Professor's office
  - Anthropology
  - Ethology
  - Mechanisms of evolution
- Jagiellonian University Museum with exhibitions:
  - scientific library
  - the treasury of Nicolaus Copernicus
  - room of the National Education Commission
  - exhibition of clocks
  - Karol Olszewski's laboratory (the first sprinkled air and oxygen)
  - chemistry museum
  - physics museum
  - exhibition of telescopes

As you can see, the choice of topics is very large, and everyone can find something interesting. Most of the museums have free tickets on selected days.

6. The Museum of Municipal Engineering is unique because it includes both the Museum and the Garden of Experiences. The Museum of Municipal Engineering is located in the historic hall of the oldest tram depot in Krakow. It is a unique complex on a European scale. The permanent collection consists of cars, motorbikes, and trams. Temporary exhibitions show the fun of technology and science.

A branch of the museum is the Garden of Experiences. On the area of over 6 hectares of the park, there are:

- devices demonstrating the phenomena of physics,
- geological exposition "Geo-garden",
- sensory exposure "Smell",
- green labyrinth with quotes from Stanisław Lem.

In each season (from the second half of April to the end of October) the garden offers sight-seeing, participation in workshops, and demonstrations of spectacular scientific experiments.

7. The garden of experiences described above is not the only outdoor activity that the inhabitants of Krakow can take advantage of. We also have a zoo in Krakow. The zoo in Krakow is a medium-sized zoo. Currently, it exhibits over one thousand four hundred 1,400 animals, representing about two hundred seventy 270 species. Endangered animals constitute a large group (over 100 species). The zoo is located in the Wolski Forest - a beautiful forest park, unique in large urban agglomerations. It is a favourite place of rest for the inhabitants of Krakow, with numerous marked walking routes. Many of them run close to the Zoological Garden, which is often a popular destination for walkers. There are bicycle routes and an educational path in the Wolski Forest. It is a place where there are several historical buildings, for example, Independence Mound for Józef Piłsudski as well as the monastery and hermitage of Camaldolese.

8. Las Wolski is not the only "green" place in Krakow. There are 5 nature reserves in Kraków with a total area of 48.6 ha (0.15% of the city's area):

- Bielańskie Rocks (1.73 ha) - the subject of protection: spontaneous succession processes of forest biocoenoses on rocky terrain, formerly devoid of the forest;
- Bonarka (2.29 ha) - the subject of protection: geological reserve, geological and tectonic faults, abrasive surfaces, exposed Jurassic, Cretaceous and Tertiary formations;
- Maiden Rocks (6.41 ha) subject of protection: Jurassic gorge with limestone outcrops, natural beech and oak-hornbeam forest;
- Rocks Przegorzalskie (1.38 ha) rock with xerothermic vegetation;
- Skończanka (36.77 ha) subject of protection: limestone log hill with diverse biocoenoses, fauna stand of xerothermic environments, including rare and endangered species of insects.

9. There are three hundred and fifty-eight 358 natural monuments in Krakow (as of 2022):

- 1 erratic boulder
- 1 karst spring
- 1 avenue of trees
- 355 individual trees of different species

The avenue of trees is heavily visited on weekends. It leads to several attractions in Krakow: Kościuszko Mound, the Museum of Wax Figures, the historic cemetery, and others. It is a popular place for walks.

10. Tech trails are further outdoor activities. We have 2 Technical Routes in Krakow: Krakowski and Grzegórzecki. The Krakow Technology Trail is an urban route of industrial heritage - the first of its kind in Poland. Its route connects the most valuable sites of local industrial heritage, located in the very centre of the city and in its close vicinity. It includes 17 buildings and complexes of exceptional historical and architectural value, related to industry, communication, energy, gas, fire, and flood protection. They were built in the 19th and 20th centuries according to the designs of the most outstanding Polish and foreign architects, conservators, and builders at that time. The Grzegórzecki Techniki Trail - these are five places related to the history of industrial plants in this district of Krakow.

11. 12. It was also decided to include the media offer - the Internet and TV - in the research. I wanted to compare how many people use informal science education without leaving home.

### *Data Analysis*

The collected data was analysed using the program <https://www.naukowiec.org/program-statyczny.html>. This allowed to conclude that the obtained differences between the results are significant from the point of view of statistics. Pearson's linear correlation coefficient was used to calculate the relationship between the obtained data and the tested people, which tells us what the strength and direction of the linear relationship is between 2 variables.

### **Research Results**

All respondents answered 24 questions. 12 questions were single-choice closed questions. The respondents were to answer the question: Have you come across the term ...? These questions list the researched non-formal education methods available in Krakow. The next 12 questions asked how often they use them. The results are shown in the table below.

**Table 2**  
*Percentage of Participants' Answers to Questions*

	YES	1 - I never participate	2	3	4	5 - I always participate
1 Science festival	73	43.3	26.2	16.5	9.5	4.5
2 Open days	97.5	23.8	30.2	26.7	13.7	5.6
3 Night of scientists	64.9	56.3	17.1	12.1	8.9	5.6
4 Museum night	95.6	34.3	19.8	21.9	14.6	9.4
5 Natural history museums	63.3	34.1	35.6	19.7	7.1	3.5
6 Engineering museum/experience garden	33.3	47.9	25.3	16.9	7.4	2.5
7 ZOO	98.5	11	33.2	28.8	17.2	9.8
8 Nature reserves	61.9	33.9	33.9	20.8	8.1	3.3
9 Natural monuments	79.4	31.2	36.6	20.4	8.6	3.2
10 Technique trail	35.9	53.6	23.7	13.9	6.2	2.6
11 TV	100	6.1	21.8	29.4	24.6	18.2
12 Internet	100	14.9	23.9	26.8	20.6	13.8

All respondents know that there are educational programs on TV and websites on this subject. Many respondents (over 90%) know about the existence of the ZOO in Kra-

kow, as well as about "open days" and "nights of scientists". The least known are the engineering museum/experience garden and technique trail - only slightly more than 30%.

However, although most learning opportunities are known to respondents, they rarely take advantage of these opportunities. Let's take a look at the individual possibilities:

1. 73% of respondents have heard about the Festival of Science and Art in Krakow, but over 40% of them did not take part in it even once. The fact that 43.3% of Krakow's inhabitants did not participate in the science festival is amazing. The main square is the main meeting place for the inhabitants of Krakow. Apart from several museums, two churches and historic tenement houses, there are also many restaurants. There are also numerous attractions on the main square - Cracovians are used to free attractions on the market, for example Kraków nativity scenes competition, Lajkonik, Dragon parade ... Therefore, it is strange that 70% of Cracovians never or very rarely participated in the science festival in the main square.
2. Open days - as we can see, this event is well known to the inhabitants of Krakow 97.5% of respondents have heard about the university / school open days, but over 20% of the respondents did not take part in it even once. Almost all of the respondents heard about the open days. However, only about 20% of respondents take part in it always or very often. Usually, the respondents are only interested in the open day of the institution they are going to attend.
3. Although the Scientists' Night has a fifteen-year tradition, only 64.3% of respondents have heard about the scientists' night, and over 55% of the respondents did not take part in it even once. The organizers on their website write "Małopolska Poland Scientists' Night! This slogan is known to every inhabitant of the region." However, this is not true - 45.7% of respondents have not heard about this action. On the other hand, as the chart shows, the number of event participants is growing. Taking into account the number of inhabitants in Krakow, about 10% take part in this event. Comparing it to the results obtained by the event, it turns out that there is a constant group of people participating in this event.

**Table 3**

*The Number of Participants of the "Night of Scientists" According to the Organizers*

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A number of participants	3500	15000	20000	28000	31000	46000	55000	57000	70000	77000	63000	73000	70000	55000

4. The event "Museums Night" is well known to the inhabitants of Krakow. 95.6% of respondents have heard about the museum night, but over 30% of them did not take part in it even once. Krakow has one of the richest museum collections in Central Europe. These collections are very diverse - everyone should find something interesting. Krakow has one of the richest museum collections in Central Europe. Therefore, it is strange that Cracovians do not take advantage of the free offer during museum nights.

5. Also Krakow has many natural and scientific museums, but only 63.2% of respondents have heard about them and over 30% of the respondents have never been in them.
6. Although the offer of the Museum is very interesting, it is only 33.2% of respondents have heard about the Museum of Municipal Engineering, Garden of Experiences, but over 45% of the respondents have never been in it.
7. The zoo is the most famous of the natural attractions of Krakow. 98,5% of respondents have heard about the ZOO in Krakow, but over 10% of the respondents have never been in it.
8. 61.9% of respondents have heard about the nature reserve in Krakow, but over 30% of the respondents cannot point to any.
9. 79.4% of respondents have heard about the natural monuments in Krakow, but over 30% of the respondents cannot point to any.
10. The technique trails are not a popular attraction, only 35.9% of respondents have heard about the Technique Trails in Krakow, and over 50% of the respondents never walked them.
11. 100% of respondents have heard about the online science portals, but over 14% of the respondents never uses them.
12. 100% of respondents have heard about the scientific television programs, but 6% of the respondents never uses them. We can see that more people take advantage of non-formal education without leaving their home.

## Summing-up

As we can see, different forms of informal science education are used by people with different frequency. The research tried to find the relationship between gender, age, level of education and its type, and the preferred form of informal education.

Only weak correlations were found between:

- the gender of the respondents and the frequency of participation in open school / university days (in Poland, mothers are responsible for the education of their children);
- the age of the respondents and the frequency of visiting nature museums, the ZOO and walking along the technology trail (the older the more often).

For most of the questions, a weak correlation was found with the level of education and the frequency of participation in informal science education. The type of education does not have such a large impact on the use of informal science education in Krakow. Research shows that despite the rich offer of informal science education in Krakow, people don't take advantage of it. The higher the education of the surveyed people, the more often they use this offer. It can be said that informal education increases the educational gap between people.

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