



7TH INTERNATIONAL CONFERENCE OF
EDUCATION,
RESEARCH AND
INNOVATION

CONFERENCE PROCEEDINGS

SEVILLE (SPAIN)
17-19 NOVEMBER 2014

Published by
IATED Academy
www.iated.org

ICERI2014 Proceedings
7th International Conference of Education, Research and Innovation
November 17th-19th, 2014 — Seville, Spain

Edited by
L. Gómez Chova, A. López Martínez, I. Candel Torres
IATED Academy

ISBN: 978-84-617-2484-0
ISSN: 2340-1095
Depósito Legal: V-2632-2014

Book cover designed by
J.L. Bernat

All rights reserved. Copyright © 2014, IATED

The papers published in these proceedings reflect the views only of the authors. The publisher cannot be held responsible for the validity or use of the information therein contained. Some conference presentations may not be available for publication.

READY-TO-SERVE GEOLOGY! PORTABLE KITS FOR SCIENTIFIC DIVULGATION TO PEOPLE WITH FUNCTIONAL DIVERSITY

A. García-Frank¹, M. Gomez-Heras², L. Gonzalo Parra³, M.L. Canales Fernández¹, M.B. Muñoz-García¹, L. González-Acebrón¹, R. García Hernández¹, D. Hontecillas¹, N. Iglesias Álvarez¹, R.W. Salazar Ramírez¹, O. Fesharaki¹, T. Navalpotro¹, M. Reviejo¹, A. Rodrigo Sanz⁴, B. del Moral⁴, G.N. Sarmiento¹, S. Ureta¹

¹ Universidad Complutense de Madrid (SPAIN)

² Universidad Politécnica de Madrid and Instituto de Geociencias (CSIC, UCM) (SPAIN)

³ Fundación Once para la Atención de Personas con Sordoceguera (SPAIN)

⁴ Instituto Geológico y Minero de España (SPAIN)

Abstract

Educational perspectives are usually low when designing curricula for people with functional diversity and there are few attempts to promote scientific divulgation among these collectives. Geodivulgar is a pioneer project for the divulgation of geology among people with functional diversity in Spain. The working group of Geodivulgar is formed by different partners, and includes university lecturers, graduate and postgraduate students, and technical staff from the Universidad Complutense de Madrid (UCM) and other universities and research institutions as Universidad Politécnica de Madrid (UPM), Consejo Superior de Investigaciones Científicas (CSIC) or Instituto Geológico y Minero de España (IGME) and also some foundations (FOAPS: Fundación Once para la Atención de Personas con Sordoceguera) and non-profit associations (CSB: Ciencia sin Barreras).

Multisensory material by itself helps people with functional diversity to enhance their communication skills. Nevertheless, Geodivulgar's perspective goes beyond the usual divulgation model adding a social interaction perspective and the integration of several society groups (lecturers, researchers, students and end-users).

The first programmed workshops were carried out in a university (UCM) in a big city with a relatively wide cultural offer for disabled people, but since then, there was a demand from areas with low population for this kind of workshops. Therefore, portable kits were prepared so they could allow combining indoor and outdoor geology divulgation activities in areas with a limited cultural offer for people with functional diversity. These kits are an optimum solution for small groups in outside areas and create new alternatives for scientific divulgation. The use of portable kits makes possible a faster assemblage of divulgation activities compared to conventional stationary workshops as they are ready-made. They provide a wider diffusion since the end user do not need to inhabit nearby a university or research center and there is the possibility of combining them with field experiences, which in turn result in a much better understanding of geological concepts.

The interest of these traveling experiences is also evident from a social perspective, as they promote interactions with scientists who are normally not available to these groups. These experiences have also an educational purpose for the students who are involved as divulgators as they improve transferable skills, such as their communicative skills, and increase their awareness to diversity that will be of use in their future professional life.

Keywords: Divulgation, Functional diversity.

1 INTRODUCTION

Geology promotes values of respect for the environment and the planet we live in, and should be accessible to ALL society. "Geodivulgar: Geología y Sociedad" is a pioneer project which pursues disseminating geological knowledge to all society, including people with functional diversity in Spain. The project was launched in 2012 when a group of geologists noticed the necessity of divulgation of geology and earth sciences among the society. Since then, the project has achieved different goals in relation to promote geological activities covering various collectives. Some of those actions were focused to Secondary Education (ESO) students (donation of educational materials to schools and

planning of theoretical and practical workshops for students in ESO's 4th year, highlighting the role of geologists in society), and other to the general public (Geo-routes [1], [2]). But according to the motto of the project, "geology for everybody", the group began to promote also activities for people with learning disabilities (LD), firstly for Down syndrome young students [3], [4], [5], and afterwards for deafblind adults [6].

The term 'functional diversity' [7] is a much more meaningful, up-to-date, and positive concept than 'disability', which implies negative connotations. Functional diversity is the first denomination in history in which the vision of this human reality is not given negative or medical connotations, and in which the emphasis is placed on difference and diversity, which are values enriching the world we live in [7]. This new approach is anchored in a vision of human rights and in research in bioethics as a basic tool for achieving the full dignity of persons with disability [8]. It has been remarked that more of society's actors must be encouraged to participate to direct the shift toward technology that is more respectful of society's needs, so that there is a broader representation of values and interests in the process [8]. Geodivulgar aligns fully with that statement and, therefore, its perspective goes beyond the usual divulgation model, as it adds a social interaction perspective and the integration of several society groups (divulgators and end-users). In this sense, the working group of Geodivulgar is formed by different partners, and includes university lecturers, graduate and postgraduate students, and technical staff from the Universidad Complutense de Madrid (UCM), other universities and research institutions as Universidad Politécnica de Madrid (UPM), Consejo Superior de Investigaciones Científicas (CSIC) or Instituto Geológico y Minero de España (IGME) and also some foundations (FOAPS: Fundación Once para la Atención de Personas con Sordoceguera) and non-profit associations (CSB: Ciencia sin Barreras).

2 METHODOLOGY

Some may say geology is the worst known natural science for the general public and even worse for people with functional diversity. Nevertheless, geology probably is one of the natural sciences with wider applications to daily life. In addition, approaches to geological processes and materials lend themselves to both field experiences and indoor workshops. The main premise to apply those activities to the functional diversity collective is adapting their design so it is based on accessibility. In a general way, accessibility may be understood as the opportunity people have to access goods, products, and services, taking into consideration their specific needs [8].

Most frequently, actions in science divulgation take place in big cities, taking advantage of the available resources from museums or educational/research collections (universities, schools, etc.). The geological material used in Geodivulgar workshops for these activities is a result of donations from researchers from various institutions (CSIC, IGME), and university members, but also from UCM funding.

The first activities in Geodivulgar project took place indoors, mainly at the University, with preparatory visits in the case of the students with Down syndrome. These experiences had a very good reception among the public, achieving also mass media diffusion [9], [10], which led to an increase of requests for taking part in them, even from areas outside the geographical influence of the University. These requests led to the design of portable kits of geological material adapted to the public and place where activities had to be developed.

2.1 Workshop Design

Accessibility has to do primarily with overcoming the barriers that may keep people with physical, sensory, intellectual, behavioral, and other differences from enjoying certain activity. This refers to the array of material and/or human resources that enable people to enjoy such goods, products, and services and the environment in which they occur as autonomously as possible [8]. Based on these premises it is crucial a careful design of the activities linked with the portable kits. Focus is given in our case to using multisensory material, as it helps by itself people with functional diversity to enhance their communication skills.

2.1.1 *Preparing Portable Kits*

Some basic principles include 1) All the materials must be versatile enough to be used in diverse situations; 2) Size and weight of samples and equipment ought to be suitable for easy transport; 3) Equipment should not require external sources of energetic supply to be suitable for both indoor and

outdoor use; 4) Samples must have significant sensorial characteristics, such as size, shape, weight, taste or temperature, so that different collectives will be able to identify some specific properties of geological materials.

2.1.2 Guidelines for Using Portable Kits

Due to the differences in number of participants and available time for each experience, it is always uttermost necessary to plan an adequate design based in a variable sequence of modules. To develop a sufficiently diverse program which favours an integrated vision of geology, a prior module subdivision is needed. These modules must be interrelated in order to avoid a specific order of attendance, which normally is difficult to achieve due to the diversity of adaptation levels of the participants and their own time to discover different geological aspects. The main modules include: 1) Basic notions in geology (geological time, geological processes); 2) Fossils (life Evolution); 3) Minerals (identification and common uses); 4) Rocks (genesis, classification and common uses).

3 EXPERIENCES

3.1 Previous experiences

Table 1 summarises the different actions along the 2012-2014 period, with the number of diverse participants. Geological experiences for people with functional diversity began in 2012 preparing materials for young students with Down syndrome. Two different approaches were taken in this, on one hand, the construction of a landscape diorama showing the environment of Madrid during the Middle Miocene, including flora and fauna figures made with clay by students of the Occupational Center “San Pedro Apóstol” of Barajas (Madrid) [3], on the other hand, a long term project involving teachers and students of the Special Education School “Centro de Educación Especial María Corredentora” (Madrid) where several geological workshops dealing with fossils, geological time, water and other geological resources (minerals and rocks) were developed [4], [5].

Table 1. Chronogram of the actions developed during 2012-2014 and quantification of all the collectives' participation.

Participants	2012	2013					2014	
	November	April	May	June	September	November	April	June
Down Syndrome Students	24 +16	24	24				24	
Deafblind People				1	7	5		7
Blind People								20
Journalists				1	2			
UCM Students				5			12	
University Researchers/Lecturers				6			7	
IGME				1			2	
Centro María Corredentora				4			4	
FOAPS Communicator-guides				1	6		4	
UCM PAS				3			4	
Ciencia sin Barreras							18	

Workshops at the “María Corredentora” school were planned to support and reinforce the theoretical contents that their teachers developed in their academic curricula. The design of the workshops involved the creation of the first attempts of portable kits with geological samples. Some of the experiences took place in the University and others in the educational centres or even during field trips. These experiences continued during 2013 and 2014. The increasing interest shown by the members of Geodivulgar in targeting people with functional diversity and the desire of extending this activities to others field of science, led them to create a non-profit association (Ciencia sin Barreras) in February 2014 to promote these activities further than the constraints of a specific project. Therefore, from February 2014 our activities went to be “co-organised” by Geodivulgar and Ciencia sin Barreras.

3.2 Results with portable kits

The first workshop with deafblind people took place in June 2013, when a pioneer experience was developed at the Universidad Complutense. This first workshop was regarded as a test in order to see if a team involving geologists and an interpreter could transmit geological concepts to a deafblind volunteer through. A newspaper journalist followed the experience and published it [9]. This made other groups of deafblind people to want to join the experience and led Geodivulgar to develop a multiuser workshop in September 2013 at the Universidad Complutense (Fig. 1) with different modules [6]. Deafblindness is a complex reality and every deafblind person has their own particular impairment in addition to a different knowledge background, therefore the use of different activities was essential. Once again, mass media covered the workshop and it was recorded and emitted by the TV programme “En Lengua de Signos” [10] which, again, resulted in an increasing number of requests to take part in these actions to divulge geoscience. Another workshop took place at the University in November 2013, and since then, there was a demand from areas with low population for this kind of workshops. Therefore, a workshop was held in Segovia in June 2014 with several activities for blind and deafblind people.



Fig. 1. Examples of conventional stationary workshops. Universidad Complutense de Madrid.

The use of modular kits in events concerning divulgation allows more flexibility in the development of the experiences allowing simultaneous explanations, giving a particular timing for each participant. Since geological materials have rather peculiar physical and chemical properties (easily detected), this multisensory material by itself helps people with functional diversity to pick up basic concepts that the divulgators may explain individually to them. The goal of these workshops is not only that participants manipulate a certain number of geological materials, the most important thing is that they use logical and deductive thinking to reach abstract concepts related to the material used in the workshop.

The social interaction and the integration of several society groups (lecturers, researchers, students and end-users) results in an innovative divulgation model in which the space where the experience takes place is not so important.

4 DISCUSSION

The diverse approaches of each of these experiences show that portable kits are an optimal solution for science divulgation. However, there are certain limitations that must be taken into account. Table 2 summarises the foremost advantages and disadvantages of portable kits versus conventional stationary workshops.

Table 2. Comparison between the development of conventional workshops and use of portable kits.

	Conventional Stationary Workshops	Portable Kits
Advantages	More spectacular samples	Faster assemblage of divulgation activities
	More indoor space/room (generally)	Wider diffusion
	Access to Specific Research Facilities	Possibility of combining with field experiences
Disadvantages	Participants must go to the place where the activity takes place	Fewer samples, not so spectacular
	Need to accommodate to the research/docent schedules	Some activities are impossible to accomplish
		Lower expenditure (generally)

The activities with deafblind people always need support from communicator-guides, deafblind interpreters and/or specialised interveners. This requirement conditions the planning of the activities as they have to fit in a specific time. Another restriction is related to the physical space for developing the programmed activities, as some of the user need areas without insurmountable obstacles, where the participants can walk without danger. The possibility of developing some actions is restricted to the samples suitable for transport. Thus, the availability of previously prepared material, depending on the number of participants, is intimately related with module planning (Fig. 2). Finally, the most important impediment to do all the requested workshops is of economic nature. Although all the actions are meant to be free-cost, a displacement to distant areas involves more expenditure in transport that would have to be covered by the project funds.

On the other hand, portable kits have been revealed as an optimum solution for small groups outside areas with widespread cultural offer and create new alternatives for scientific divulgation. Their use makes possible a faster assemblage of divulgation activities compared to conventional stationary workshops as they are ready-made. Whereas the latter need a previous display of scientific material and posterior clean up, the modules are already prepared and these actions minimized. They provide a wider diffusion since the end-user does not need to inhabit nearby a university or research center and there is the possibility of combining them with field experiences, which in turn results in a much better understanding of geological concepts.

Another important remark linked with these experiences is of sociological nature. The interest of these traveling experiences is also evident from a social perspective, as they promote interactions with scientists who are normally not available to these groups. The dynamic component of the interrelationships allows that both mediators and final receptors can participate asking whatever thing they want to know concerning geology to an expert. For the divulgators is also an enriching experience, since it implies to learn how to explain certain things using different language channels and dealing with difficulties rarely found in standard teaching situations.



Fig. 2. Several modules of Portable Kits. Segovia.

These experiences have also an educational purpose for the undergraduate and graduate students who are involved as divulgators as they improve transferable skills, such as their communicative skills, and increase their awareness to diversity that will be of use in their future professional life. This is a key point, since there are few academic courses that train college students (future professionals) in the area of divulgation of geology acting as a practicum. The aim of these teaching strategies is to promote independent learning actions for students in order to manage programs of geological divulgation and favor the design of active acquisition processes, competencies and skills for professional practice. Students are intimately related to the design of these portable kits and specific resources for commissioning new and practical methods of science diffusion to different collectives.

The development of an independent learning style allows students to see the connection between the academic studies and the work setting. From this perspective, students can complement, refine and contrast knowledge acquired during academic lessons. In these workshops they learn to adapt to specific situations of divulgation and learn to react to unexpected circumstances. These strategies favor teamwork and develop student creativity, fully profiting the premise of "learning by teaching". Participation in extracurricular tasks may result in increasing their employment opportunities since the acquisition of different communication skills will be useful in any job.

5 CONCLUSIONS

A first remark, beyond the specific contents of multisensory workshops, it is the right of everyone to enjoy the benefits of scientific progress and its applications. Here we propose an alternative offer based on divulgation of scientific contents, intended for collectives that otherwise would find difficulties to access. This accessibility includes various issues such as direct adaptation to sensory needs and levels of abstraction of each particular individual (i.e. collectives with functional diversity), as well as flexibility in the schedule and place to be performed. The interest is also evident from a social perspective, as these actions promote interactions with scientists who are normally not available to these groups.

The workshops can be carried out in big cities, with a relatively wide cultural offer, but also in areas with low population. Therefore, portable kits allow combining indoor and outdoor geology divulgation activities in areas with a limited cultural offer for people with functional diversity. These kits are an

