

APPROACH TO THE EARTHEN ARCHITECTURE ACTIVITIES CARRIED OUT IN THE 2016 UPV SUMMER SCHOOL

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Abstract

This paper presents the activities and workshops which took place in the UPV summer school during the month of July 2016, in the framework of educational and dissemination activities promoted by the UNESCO Chair of Earthen Architecture, Building Cultures and Sustainable Development at its headquarters in the UPV (directed by F. Vegas and C. Mileto).

The main objective of these activities was to bring earthen architecture and its construction to children of different ages and levels, from 6 to 12 years old. This set of activities is carried out in a specific area of the campus of the University called "The corner of the Earth", a large outdoor space where the workshops are conducted. For each level, we designed specific activities carried out in different workshops structured sequentially through various levels. Therefore, there was a continuity as regards long-term learning, since many of the UPV summer school students tend to be the same year after year, and in this way, students who start the activity in the first level may go on to do each of the activities during the successive summers.

The methodology of the proposed activities is common to all levels. There are workshops which are an educational resource based on active methodologies ("learning by doing") with students who learn to use the various earthen construction techniques with their own hands, actively collaborating in a common objective, making a small building together, encouraging teamwork and collective participation. The practical focus of the activity through experimentation and proposed active methodologies gave the students the opportunity of getting to know various construction techniques, all associated with the humble yet valuable material that is earth. Moreover, they gave students the chance to promote further knowledge of alternative technologies, in all its facets, favouring aspects that may be useful for the enhancement of non-conventional building systems as potential instruments generating economic wealth and culture in disadvantaged settings, promoting a sustainable economy.

Keywords: workshops, earthen architecture, development education.

1 GENERAL FRAMEWORK OF THE ACTIVITY

1.1 Introduction

The materials used in construction in a specific region are a basic reflection of its culture. Earthen architecture, in its different construction variants, is an essential part of our culture both for its early origins and for its technological variety and adaptation to natural and cultural surroundings. However, since the 1950s, earthen architecture and construction techniques have gradually disappeared, being replaced by new standardised techniques. This situation stems from progressive lack of information and the discrediting of this traditional architecture, which has been viewed as poor quality and linked to underdevelopment. This has led to the progressive oblivion of information on earth as a construction material. Earthen architecture is closely linked to concepts such as local tradition, the development of trades, adaptation to the environment, and 0 km architecture. Learning about this type of architecture allows us to encourage reflection on different cultural and social values, associated to sustainability and on how available resources are managed currently.

Therefore, it is possible to use learning about this architecture to instil cultural, social, and environmental values into society. In addition, as these represent the society of the future it is essential to educate children and young people in these values in order to progressively develop a process of cultural recovery. To do so a series of educational workshops were organised to suit children in the primary education age range.

Children's education is clearly one of the main tools for prompting the social changes needed for sustainable development. Pedagogic studies [1] have confirmed that in childhood the brain is much

more receptive to new experiences and all sorts of learning. Therefore, executing a series of proposals to encourage early stimulation and learning about earth as a construction material contributes to the promotion of learning about more modern concepts such as issues relating to economic, social, cultural, and environmental sustainability while allowing children to gradually become more familiar with the materials.

1.2 Introduction to the UNESCO Chair

The UNESCO Chair of Earthen Architecture, Building Cultures and Sustainable Development / UNITWIN, is directed by Hubert Guillaud from the CRATerre research centre (Grenoble), and is formed by the UNITWIN international network with 44 partners in Africa, Latin America, Asia, and Europe [2]. The 4 European members of the chair are Spain, Italy, France, and Portugal. The Spanish representatives of the chair are teachers Camilla Mileto and Fernando Vegas from the Universitat Politècnica de València (UPV). The Chair constitutes a cooperation network which incorporates teaching, research, and training activities. It supports local initiatives and dynamics, promoting synergies on an international scale, thus favouring and stimulating dialogue between countries and continents to facilitate the exchange and transmission of information and know-how. The work of the Chair is based on the relationships of higher education, professional training, basic and applied research, information, documentation, and exchange in the field of earthen architecture. It works on three major blocks of content: the environment, human settlements, and habitat; earth as material and ecological materials; and the environment and heritage.

1.3 Introduction to the Summer School (Escola d'Estiu)

Every month of July for the last 30 years, the Summer School or *Escola d'Estiu* of the Universitat Politècnica de València (UPV) [3], has provided different cultural, creative, and sports activities for the youngest members of the university community. More than 1 000 children and teenagers aged from 4 to 15 registered to take part in the most recent edition, with over 100 experienced monitors whose aim was to make the Summer School an unforgettable experience for everyone.

The last two editions of the Summer School have incorporated the *experimenta.upv* [4] programme, a project which aims to bring science to children through the collaboration of different departments and laboratories of the university. Different activities and workshops are used to bring science and technology to children so that they can experiment and learn more about some of the tools and the opportunities these offer.

The *experimenta.upv* programme has brought the values of traditional earthen architecture and children closer together. The workshop "The corner of the Earth" was set up in collaboration with the UNESCO Chair of Earthen Architecture, Building Cultures and Sustainable Development. The first experimental activity was carried out in 2015 with 200 children aged 11 and 12. However, this year co-funding was provided by the Department of Development Cooperation of the Universitat Politècnica de València, and the project was expanded to cover a wider age range, so that approximately 600 children aged from 6 to 12 took part during their time in the UPV Summer School in July 2016.

2 MAIN OBJECTIVES

In this general framework, depending on the age of participants, different activities were carried out in order to develop the following main objectives:

To promote and publicise the building actions aimed at alternative technology practices, characteristic of developing countries. The most important of these is the use of earth as a building material in its many forms.

To assess, reflect on, and recognise models or examples of building which represent moral, cultural, and socio-economic values associated with building practices with earth. The aim of this is for children to work on environmental values (respect for nature, reducing pollution, using healthy materials, etc.), socio-cultural values (protection of cultural landscape, transmission of local building culture, recognising immaterial values, promoting cohesion and social cooperation, etc.) and socio-economic values (encouraging independence, optimising efforts in construction, economising on resources, etc.) [5].

To raise awareness of the potential for building with earth as a traditional, economic, and ecological building source and resource to be found in a variety of cultures and geographical locations. Earthen

architecture - in all its variants - constitutes cultural heritage in many countries. In each place and cultural reality vernacular architecture is born of the environment itself, using local materials and blending into its surroundings. At present earthen architecture is a cultural heritage element that is also paving the way for new constructions with sustainable materials and processes.

3 METHODOLOGY

The activities proposed share a common methodology based on “Learning by doing” [6], where students use their own experience to deduce and acquire theoretical knowledge on a specific subject. Using other resources such as play or role-playing games, combined with individual or group activities, they have a single common objective, for children to be able to learn in an entertaining dynamic way.

The activities, divided into different workshops, were structured into three blocks to match three educational blocks divided by students' age. The first block was carried out in the First Stage (6, 7, 8 years); the second block was carried out in the Second Stage (9, 10 years); while the third block covered both Second and Third Stages (11, 12 years). The activities were developed in each stage with a total of two one-and-a-half hour long sessions each.

These activities were designed specifically for each age range to ensure continuity as regards long-term learning. The activities described below were developed in the 2016 Summer School.

4 DEVELOPMENT OF ACTIVITIES

The activities were designed with two main points in mind: continuity in learning (that is to say, a student taking part in activities in subsequent years will reach increasingly complex learning objectives with each level) and cooperation to reach a common goal (executing a small building resulting from everybody's joint effort).

The different activities are divided according to age group, taking into account individual levels of difficulty, and learning both specific themes from a given technique and general information relating to the use of earth as a construction material. Thus, once students complete the workshops they will be able to understand each of the specific issues surrounding earthen architecture, its cultural values, and some of its building techniques.

The workshops were structured into three blocks arranged by approach, proximity, and depth of analysis. The first block studies the basic raw material, earth in granulated form. It is essential to understand the raw materials in order to understand the behaviour of earthen architecture and concepts relating to construction and structure. The second block is an approach to architecture, studying the *raison d'être* of earthen architecture. Students need to understand why earthen architecture exists and what some of the intervening factors are. Finally, the third block carries out an in-depth study of some of the most common earthen construction techniques.

The practical part of each workshop was proposed in direct relation to the age of participants, depending on technical difficulty. In addition, the theoretical component of these activities is less than that of the practice and was carried out in a university classroom using graphic material (PowerPoint and intelligence bits/flashcards), and play material (games, puzzles), which made learning much more entertaining, quick, and visually appealing to the children. Several intelligence bits/flashcards were designed, these were units of information, visual information cards that the children could use to reinforce the concepts that they had worked on in the activities.

The main emphasis of these workshops was cooperation. Each of the specific workshop objectives was achieved by maintaining an objective that was common to all stages. To a greater or lesser extent all these stages contributed towards the construction of a small house made of earth, with over 600 children taking part in a major common project. Children need to understand the importance of belonging to a group and feeling that they share a major common goal. The students are aware of the importance of collaboration, cooperation, and groupwork. They understand that what they do has an effect on others and on final success [7].



Fig. 1. Start and end of the group construction.

4.1 The raw material

In order to understand earthen architecture it is important to understand the raw material used in its construction - earth. Earth is part of a large family of granulated materials with similar physical and chemical properties. These materials are made up of mineral grains, and include concrete, mortar, etc.

This block was developed in the First Stage (6, 7, 8 years), which worked with grain matter in a sensory, experimental, and very visual way. We aimed to analyse the property of the material outside the laboratory, simply using our hands. The earth was made up of grains in different sizes (stones, gravel, sands, limes and clay), together with air and water. Mixed in different proportions these made up a soil whose characteristics and geological history made them unique [8]. Experimental studies were carried out on each of the elements which make up the earth in order to learn more about the similarities and differences in their behaviour.

Three activities were developed within this block. The first of them was sensory, the second was based on several scientific experiments, and the third had a major artistic component. They thus examined the material properties in a direct, deductive, visual, experimental, and entertaining way.

The aim of the sensory activity is to get to know the earth through sight, hearing, scent, touch and taste. Discovering the characteristics of each of them, seeing what makes them similar and what differentiates them. There are numerous types of earth, with different granulometry, composition and origin. This is reflected in their colour, grain size, roughness, hardness, etc. Each of these aspects is analysed in this activity.

The second activity uses small scientific experiments to analyse the properties of the grain material and whether or not its behaviour is suited to construction. Small exercises were designed to analyse each of the items which form the earth - the grains, water, and air - as well as the properties of the earth, such as plasticity, strength, compaction, etc. Defining each of these aspects provides a material which can be used to build a wall, structure, or building. It is essential to understand the raw material which will subsequently become part of a structure. Understanding the raw material sheds light on the construction logic and any related structural aspects. Each and every one of the small exercises proposed is completely experimental and the aim is for the students to learn by experimenting and discovering, learning from their mistakes.



Fig. 2. Sensory activity

Finally, there is room for creativity in this second activity. By developing activities with an artistic component we understand all the possibilities that earth has to offer, giving free rein to the imagination and creativity of each student. The smallest ones did drawings using clay, both individually and in groups, producing a painting with their hands and feet, as well as designing a large mural together with all the students from the course. The slightly older students in the block learned how to mould earth, finding out about its properties and plasticity and observing changes in behaviour depending on the amount of water used. As in the case of the younger children, they worked individually and in groups, both building their own structure and then creating small handmade bricks which were later used to build the small house.



Fig. 3. The artistic activities.

4.2 Earthen architecture

This second content block was executed for the Second Stage (9, 10 years), learning more about earthen architecture, about its *raison-d'être*, its origins, and all the possible variants we might find.

The material in granulated form, earth, is extremely common throughout the world, so logically many constructions are made with this material. However, this fact still seems to amaze most children and most of society in general.

To understand this we need to go back to a time when there was no alternative. We have to imagine a natural setting where there is only access to natural elements such as earth, stone, wood, straw, reeds, etc. Dwellings came about to provide shelter to people in response to climate conditions and immediate surroundings, so that the characteristics of different homes can change depending on location. This activity focuses both on the concept of dwellings and on that of natural materials, and through vernacular architecture children learn about its advantages and learn to value it [9].

All students designed and subsequently built a house to scale using natural materials, and then analysed its structural and climatological aspects to find out whether the structure of the house was stable, what would happen if it rained, where the light came in, etc. Just as we can analyse our own home, other homes are examined to establish whether or not the housing is decent, stable, attractive, etc.



Fig. 4. Construction of the models.

4.3 Construction techniques

There are numerous construction techniques with earth (rammed earth, adobe, cob, wattle/daub). The location of the different techniques is linked to specific cultural aspects of the setting and the earth. This block studies the four techniques mentioned: cob and rammed earth were examined in the Second Stage, while adobe and wattle were developed in the Third Stage. The order in which construction techniques were studied was in direct connection with the technical difficulty of each, and the age of the students. With the cob and rammed earth construction the Second Stage focused on the lower part of the construction, while the Third Stage worked on the upper part.

Earthen construction is cooperative. In many cultures the construction of an element of the community involves celebration and a cultural encounter for the entire population. Taking into consideration the high degree of participation for a construction of this sort, it is essential to work as a group and in an organised fashion. Thus, everything turns out correctly, and everybody feels they have a function within the team, where everyone participates actively feeling that they belong in the group. This aspect of cooperation and groupwork was put into practice by assigning each student "roles" relating to construction. Each role assigned is of vital importance at some point in the activity to ensure that each technique is correctly executed.

The execution of the different techniques, the construction carried out, and the tools used were all adapted to the age of the children. Although no real construction tools or common measures for rammed earth or adobe were used, care was taken to ensure that equivalent adaptations should be as faithful as possible to the originals. This, in combination with the raw material, ensured that the children's experience was as close as possible to the real one.

Regarding the cob and rammed earth techniques, studied in the Second Stage, both of these were monolithic constructions. Cob is a technique used to build monolithic walls without the need for formwork and the technique consists basically in "piling up earth". As it does not require limited technical skills it is ideal for the smallest participants, the 8-year-olds. Rammed earth is the direct evolution of cob, building monolithic walls, this time with the help of formwork, which is why it was proposed immediately after cob, in the next course, that is to say, for 9-year-olds.

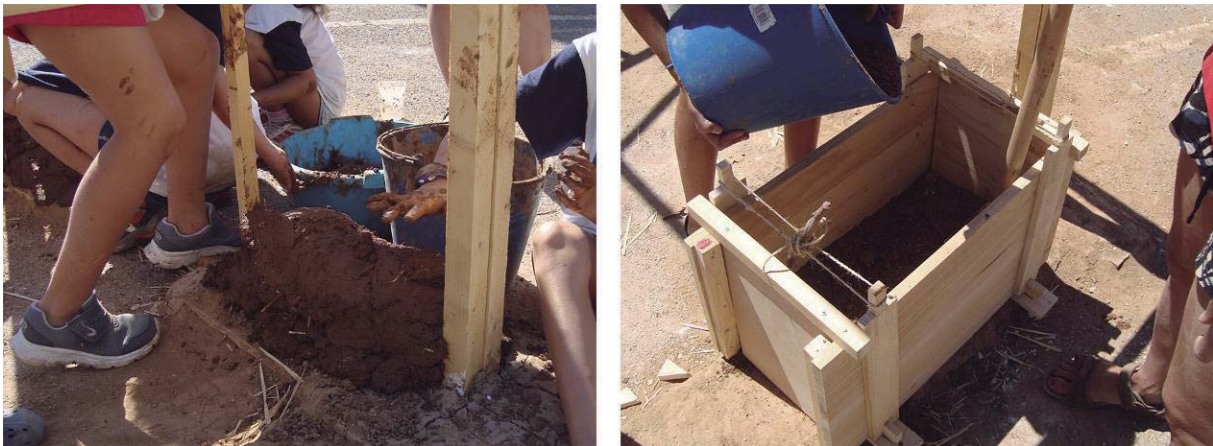


Fig. 5. Activities for cob and rammed earth.

The workshops for the Third Stage (11, 12 years) extensively cover the two remaining construction techniques, adobe and daub. 11-year-olds are in charge of the former, while 12-year-olds work on the latter. These two techniques were carried out by the older participants as they are more difficult and require painstakingly delicate work over two full sessions to cover all the aspects relating to each of them.

In the session on adobe, the children learned how to make their own pieces. They made the mix and then made their own adobe with the help of a mould, eventually using it in a construction. This use in construction is very precise and takes into account the importance of following a series of construction techniques for correct execution, introducing the concept of tools.

In the daub session, patience and highly precise work were two indispensable qualities. As this technique was employed in the upper part of the construction, and for the reasons mentioned earlier, it was decided that the profile of the older participants was ideal for the execution of the daub. At first the

rope needs to be patiently and very tightly plaited across the wooden frame which is then coated with earth. Rendering, the final step in earthen construction, was used to complete the learning. With this last exercise the children put the final touches to the earthen construction, working at that point on the most creative part, decorating the built walls with different coloured clay, small stones, leaves, etc.; and using any natural element within their reach to decorate the construction, replicating the processes of earthen vernacular architecture.



Fig. 6. Adobe production and construction process.



Fig. 7. Daub and rendering activities.

5 RESULTS

Carrying out these activities within the Summer School programme of the UPV has been a very rewarding experience for teachers and organisers as well as for the participants.

The children taking part in these workshops are aged between 6 and 12, so that the range of learning stages on offer is very wide, making it possible to offer different depths of learning [10]: from learning about the material and its artistic and creative possibilities, to an initiation in technological and scientific learning, while learning about cultural and environmental values linked to a more sustainable development.

The activity's practical approach through the proposed active and experimental methodologies has enabled the students to learn about earthen construction techniques. Handling, touching, smelling, and modelling the earth in its different states has provided the children with a complete sensory and synaesthetic experience of this construction resource. In addition, the initiation workshops for these "small scale" construction practices are activities which also encourage and perfect fine motor skills, and the capacity for concentration, together with handling and production of specific results, both individually and as a team.

The students taking part in these workshops have shown increasing levels of acceptance, enthusiasm, and attention towards the topics studied. However, the rammed earth construction activity specifically should be reviewed with a view to possible future workshops as the activity turned out to be too

complex for 9-year-olds. Despite working with rammed earth formwork to scale to make it simpler for the children, children were unable to assemble the formwork on their own given its technical complexity. In addition, as the earth tamping process requires major physical effort it should possibly be reviewed and transferred to the next stage or kept in the same stage but adapted to children's capabilities, perhaps making small rammed earth cubes to scale allowing the students to understand the earth tamping process in a simpler fashion.

The rest of the activities were developed correctly and found to be well-suited to their target age groups in terms of difficulty. These are very positive results as the warm reception of the activities proposed undoubtedly constitutes important feedback to be taken into account, as well as motivating us to continue this line of development for these tactical proposals, adapting and improving them to be increasingly suitable, and so contributing to the children's development at every stage of their learning.

NOTE

These activities were carried out within the framework of the UNESCO Chair of Earthen Architecture, Building Cultures and Sustainable Development, with teachers Fernando Vegas López-Manzanares and Camilla Mileto in charge of the Spanish branch. They are also included in the research project "SOSTierra. Restoration and rehabilitation of traditional earthen architecture in the Iberian Peninsula. Guidelines and tools for a sustainable intervention" funded by the Spanish Ministry of Economy and Competitiveness (BIA2014-55924-R, main researchers: C. Mileto and F. Vegas).

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The activity on raw material included in the First Stage uses as reference point the "Sensory Workshop" of the Terrón collective and the second activity in this stage is inspired by the "Élémenterre Workshop" developed by Ámaco.

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