

INTRODUCTION OF THE SUSTAINABILITY'S CONCEPT IN THE ARCHITECT'S TRAINING. APPLICATION AND RESULTS

F. Vegas, Y. Hernández, V. Cristini, L. García, M. Diodato, C. Mileto

Universitat Politècnica de València (SPAIN)

Abstract

This article presents the results of the application of the Project for Educational Innovation and Improvement "ARQUITECTOS para el FUTURO. La sostenibilidad como factor de calidad en la arquitectura" ["ARCHITECTS for the FUTURE. Sustainability as a quality factor in architecture"] (PIME/UPV 2017-2018), through several degree and master's subjects within the current training of architecture students at Universitat Politècnica de València (UPV).

Although sustainable thought, design and construction are not innovative activities, as it has been shown to be so by such architects as nonagenarian Balkrishna Doshi, recent winner of the 2018 Pritzker Award, Alejandro Aravena (Pritzker 2016) or Diébédo Francis Kéré (Global Award for Sustainable Architecture 2009), among others, at the UPV School of Architecture a lack of understanding of the term has been observed, as has its subsequent misguided and fragmented application. In view of the above, this project was implemented to generate teaching/learning of new knowledge, skills and competences relating to the concept of 'sustainability'.

The execution of the project was based on the learning by doing methodology through three main practical tasks. The first was to identify and define the three fields - environmental, socio-cultural and socio-economic - on which sustainability is based. The second was to examine the sustainability of historically relevant architectural constructions and 21st-century works. Finally, learning and becoming skilled in the operation of the certification tool has shown the high cognitive level of students, their extensive cultural baggage, predisposition to teamwork and excellent skills in critical thinking.

Results have exceeded the initial expectations for the project, which has produced the interest of our students in increasing their knowledge of design, composition, materials, building techniques and authors working in the field of architectural sustainability on the one hand, and on the other a fluidity in the analysis of architectural works and development of critical thinking on these in terms of sustainability.

Keywords: Sustainable architecture, architect's training, critical thinking, collaborative work, learning by doing.

1 LEARNING SUSTAINABILITY

In recent years the UPV Higher Technical School of Architecture has been examining the incorrect use of the application of the concept of sustainability to architecture. Driven by the need to clarify and further explore this topic, a group of teachers from the Department of Architectural Composition have organised, coordinated and directed a Project for Educational Innovation and Improvement: 'ARCHITECTS for the FUTURE. Sustainability as a quality factor in architecture' (PIME/UPV 2017-2018) [1], aiming to generate significant learning on the subject.

Taking into account the cognitive levels exercised in the subjects involved in the project - understanding, analysing and assessing the composition of contemporary or historic buildings - content was planned to ensure the foundations acquired in individual subjects would continue to be used when building on new knowledge. To do so three types of content were planned: conceptual, to work on new concepts, unknown or misinterpreted factors or parameters which are linked to sustainability; procedural, for students to learn a given process by repeating the same actions on different case studies, i.e. searching for information and data processing, analysis and interpretation; and attitudinal, bringing about personal improvement in individual development.

In this project, in addition to work on the curricular skill relating specifically to sustainability, other cross-disciplinary skills were developed including groupwork, effective communication, critical thinking and knowledge of contemporary problems.

2 ACTIVE AND COLLABORATIVE METHODOLOGY

In order to ensure successful general learning within the project the following specific objectives were set: raising awareness among students of the impact of design decisions in professional practice and transmitting commitment and security in decision-making, supported by basic sustainability principles and values, also acquired in this phase; validating the knowledge acquired in the previous objective by using the 'learning by doing' methodology in case studies specifically chosen by teachers; and analysing the level of sustainability of practical case studies, proposing improvements [2].

Also taking into account that a successful result - attaining set goals - requires the development of certain specific competences and skills (cognitive, procedural and attitudinal), the following tasks were put into practice to develop the three competences:

- 1 Reading, analysing and summarising the content of the publication 'Versus. Lessons from vernacular heritage to sustainable architecture' [3] in groups of 5-6 students so that every group extracted the meaning of selected parameters. These make it possible to declare the intervention as sustainable, producing diagrams, drawing and presenting them to the rest of the class and jointly creating a mind map of new terms and definitions. Thus, in this activity students worked directly on conceptual content relating to the three pillars of sustainability: environmental, socio-cultural and socio-economic, as well as the 15 parameters which define these three pillars. They have developed groupwork skills, taking on responsibilities and sharing in smaller groups before finally presenting their work to the rest of the class, and worked on effective communication - especially oral - in order to continue expressing clear and precise arguments for knowledge acquired individually.



Figure 1. Students discussing concepts and their meaning in small groups.

- 2 Identifying sustainable interventions in contemporary magazines. Teachers provided a list of open access online architectural journals from which students selected projects which they felt contained some of the sustainability parameters studied in the previous exercise. This activity was done in groups of 5-6 students, encouraging critical thinking, questioning interventions which from the outset appeared to be sustainable, although this is doubtful based on the definitions from the first exercise. This allowed students to show that they had understood the concepts, and also that they were capable of establishing correlations, comparisons, and even identifying deliberate distortions of concepts. This activity also made it possible to work with the cross-disciplinary skill of knowledge of contemporary problems, using current journals reflecting the most advanced techniques, materials and technology in the sector of building sustainability. The final group discussion in the class provided practice for oral communication, in the course of the debate generated as a result of differences in opinion.
- 3 To verify compliance with sustainability parameters of the cases proposed by a teacher in a list of well-known historic buildings in the field of architecture, filling in fiches ad hoc, and once again developing critical thinking by examining and discussing buildings considered to be of reference by architecture students, refuting or confirming these. Once again the final debate put students' communication skills to the test.

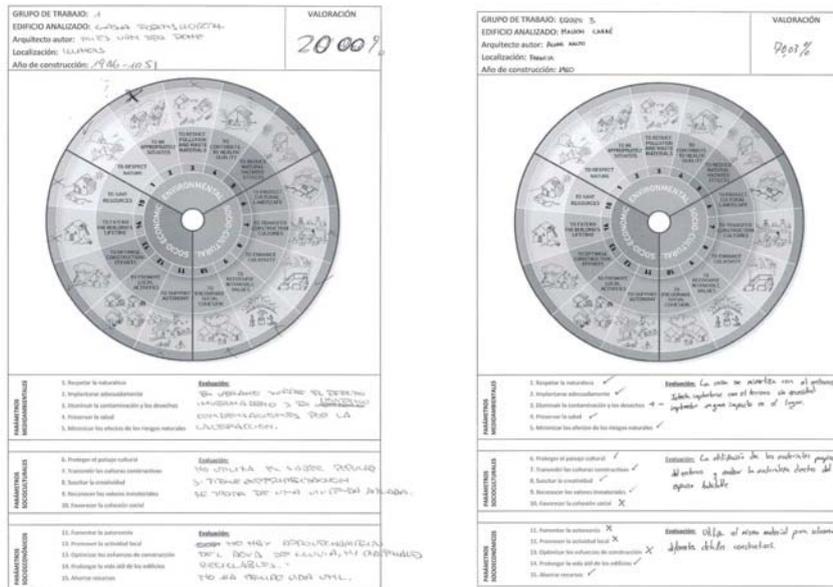


Figure 2. Fiches collated by students and defended orally.

- 4 The final activity developed within the project was the demonstration and testing of VERDE interactive software. This task showed the students the professional software currently used in the field of architecture in the identification of sustainable buildings. The students individually used computers to test this free online tool, endorsed by the Green Building Council España (GBCE). The simplified version tested, *Herramienta de Ayuda al Diseño de Edificios Sostenibles* [4] quantifies environmental, social and economic improvements by applying sustainability criteria to projects. The students selected a building previously analysed with a wheel of sustainability, further examining it with the software to ascertain how the measures implemented reduce environmental, economic and social impact. This allowed students to calculate the degree of sustainability of a project as well as identifying weak points and alternatives for potential improvement.

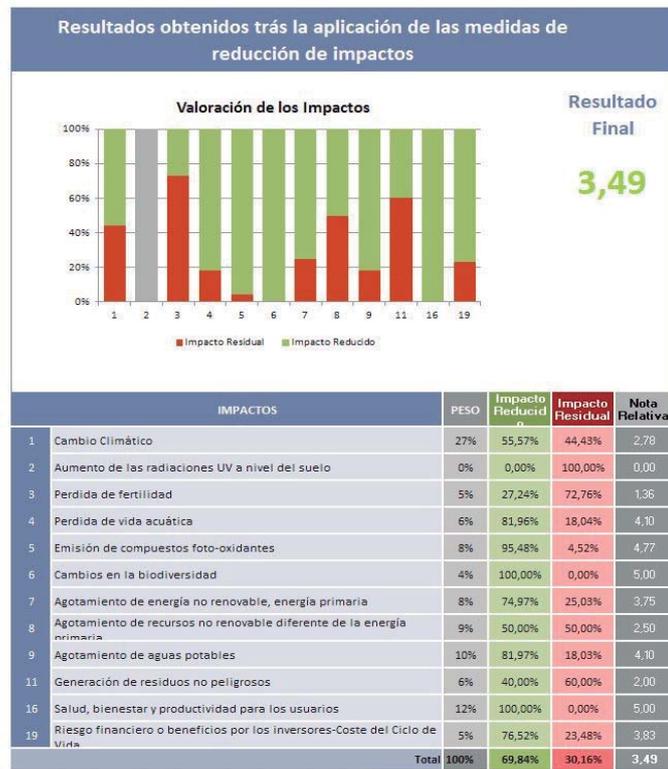


Figure 1: Example of results following application of VERDE HADES.

The first three activities were divided into three 90-minute classes, while the fourth task took place over two 4-hour sessions.

As can be observed the project was applied following the learning by doing methodology. In the conviction that in order for learning to be significant it needs to be self-built, care was taken to avoid master classes or any activities in which students were not active participants, instead choosing tasks requiring the active collaborative participation of students.

3 RESULTS AND CONCLUSIONS

The learning results achieved the initial conceptual, procedural and attitudinal goals so that the students made the following progress:

In terms of conceptual learning results, the meaning of the word 'sustainability', the three major fields to be taken into account when discussing sustainability and the 15 parameters which determine whether an intervention is environmentally, socio-culturally and/or socio-economically sustainable. These results also go beyond direct learning, making it possible to distinguish concepts which differ in meaning despite having points in common. Students are able to use a series of terms relating to architecture correctly, including 'zero kilometre', 'low teach', 'bioclimatic', 'passive', 'ecological', 'bioconstruction', 'permaculture', etc.

From procedural learning students were able to apply the 'wheel of sustainability' analysed and learnt in the first task as a qualitative analysis method which can be used to justify the sustainability of a given project. In addition, students learnt to use HADES quantitative analysis software to certify building sustainability. In this case results exceeded expectations as students used the methods learnt - including the 'wheel of sustainability' -, outside the project in other exercises from the same subject. As Monereo (2007) said, being competent in something is not just being skilled in specific tasks, but also knowing how to apply acquired skills in other fields and new tasks [5]. In fact, with respect to this we were surprised by the application of a method we have termed 'going through the wheel of sustainability'. In a debate one of the arguments against the architecture of Santiago Calatrava used this method to show that his architecture was not sustainable. Students were therefore able to extrapolate a method acquired in the case-by-case study of architectural interventions to a set of actions which define the professional career of an architect.

In terms of attitudinal learning results, students showed themselves to be patient, understanding, empathetic, cooperative and able to recognise the overall benefit of merging different ideas. They were able to distinguish between work produced and individual ego, so that any criticism of the work - always constructive - did not spill over into personal feeling. This improved the task while promoting individual growth in values, beliefs and feelings. It should also be stressed that personal improvement was even greater when working in groups with members from other cultures, with different customs, values and habits.

Observing individual evolution in different tasks it can be stated that students developed skills and competences including effective communication, showing that having knowledge is as important as being able to transmit it; adopting a critical attitude, expressing curiosity and motivation beyond the immediate subject under discussion; staying up-to-date in the field of architecture and now also in the field of sustainability, assessing recurring problems to be tackled when designing a project; and working as part of a team, distributing roles and responsibilities in an atmosphere of trust, collaboration and understanding.

In conclusion, in view of the learning results obtained from the implementation of the project we believe that our students' experience of significant learning makes them perfectly qualified to be Architects for the Future.

REFERENCES

- [1] Vegas, F., ARQUITECTOS para el FUTURO. La sostenibilidad como factor de calidad en la arquitectura, convocatoria PIME/UPV 2017-2018, inédito.
- [2] Vegas, F., Hernández, Y., Mileto, C., García, L., Diodato, M., Cristini, V., Architects for the future. Updating and transferring content through new learning experiences, en AA.VV, INTED2018, 2018.

- [3] Correia, M. et al., Versus. Lessons from vernacular heritage to sustainable architecture. Edited by ENSAG-CRAterre, 2014.
- [4] Hades. Herramienta de Ayuda al Diseño Sostenible. Accessed 15 genuity, 2018. Retrieved from gbce.es/es/pagina/herramienta-de-ayuda-al-diseno-hades [08/05/2018].
- [5] Morales, E. et al., Competency-based skills through learning objects en RED. Revista de Educación a distancia, nº 36. Retrieved from um.es/ead/red/36/morales.pdf, [02/05/2018].