

Article

Combining Management, Education and Participation for the Transformation of Universities towards Sustainability: The Trébol Programme

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Abstract: This article presents the design and development of the ‘Trébol (Clover) Programme’, a tool which allows us to improve environmental sustainability in the university environment by reinforcing the education, awareness, and training of its members. The system for certifying ‘good practice’ is divided into four progressive levels, and a certificate is awarded in order to demonstrate the environmental commitment acquired to third parties. The aim of the whole process is to create a practical forum for participation, communication, motivation and competence, which is necessary to foster effective pro-environmental behaviour. The study took place at the University of Córdoba (Spain), and, since it began in the 2013/2014 academic year, over 50 groups a wide range of areas have taken part, making a total of nearly 600 participants. The results show that the Trébol Programme enables environmental commitment to be put into practice, through continuous, systematised, participative and well-organised improvements in environmental performance. Its potential as an educational resource for environmental improvement should also be noted, by boosting environmental awareness and establishing new norms. It fits in well with the principles and areas of action of Education for Sustainable Development, and can be applied to universities and other settings to bring about a shift towards sustainability in the fields of teaching, research and management.



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1. Introduction

1.1. Management and Environmental Education to Face the Crisis of Unsustainability

Global environmental problems have now become a focus of a major political debate which echoes the growing awareness about the difficult relationship between industrialised societies and the environments on which they depend [1]. The ultimate cause of these problems is the current model of global development, which relies on mass-scale production to achieve unbridled growth by overexploiting the natural resources [2–4]. The environmental crisis, as stated by Leff [5], must be seen and dealt with as a crisis in our knowledge and our model of civilisation, and it is vital to analyse its original causes and future projection.

The biggest challenge, and at the same time the great paradox of this ecological crisis, is the combination of a high level of awareness with our apparent incapacity to carry out the necessary social change. Not until the educational paradigm is transformed on every level can there be real solutions [6]. We must therefore see environmental education, which in

recent decades has been known internationally as ‘Education for Sustainable Development (ESD)’, as a fundamental component for the construction of sustainability.

ESD is a permanent process which works towards competence for action [7] in order to incorporate environmental factors into decision-making in the personal, work and social spheres; it also constitutes a useful tool to encourage individuals and groups to participate and take on more responsibility for solving environmental problems. There is therefore a very close link between environmental management and education [8].

It is therefore in our interests to search for tools and processes to facilitate good environmental management through ESD with the people involved in its development. As Herremans and Allwright [9] demonstrate, it is essential to have the right attitude, awareness and commitment to achieve effective environmental management systems. However, these authors also point out that the potential for participation does not seem to have been fully exploited, since management processes are generally carried out by teams of experts, while single participants do little more than agree or disagree with the established measures. For this reason, we need to explore new, more participative environmental management practices which would lead to increased participation and permit a more natural approach to these management systems.

A large number of studies have revealed the gap between environmental knowledge and awareness and active pro-environmental behaviour [10]. Despite there being a high level of awareness, there is much less involvement in responsible pro-environmental behaviour [11]. One of the main drawbacks of this contradiction, which is typical of complex systems [12] and environments of uncertainty [13], is precisely that people do not participate [14]. Among the factors that influence this gap, it is worth noting that there is a dilemma over whether action should be organised on a collective level (through so-called ‘top-down’ strategies directed by the organisation leaders) or on an individual level (through ‘bottom-up’ strategies coming from individual citizens) [15].

One of the great challenges of ESD is precisely how to downplay this dilemma, by emphasizing the need to tackle environmental problems through training for action by both individuals and groups [16]. From an individual perspective, ESD requires all citizens to acquire or increase their environmental awareness, which is defined as the set of skills, knowledge and experiences that the individual actively uses when interacting with the environment [17]. As a multidimensional concept, it combines all environmentally related knowledge, beliefs, values, attitudes and behaviour [18]. Applied learning and boosting the relationship between these areas lead to greater motivation and competence, which are key prerequisites for effective pro-environmental behaviour [19], thus setting off a continuous, progressive spiral towards increasingly mature states of environmental awareness.

The idea of behavioural control is therefore determined not only by internal, but also by external variables [20]. Thus, from a group perspective, ESD enables individuals to perceive our environment as a ‘sustainable ecosystem’ [21], and strengthens the perceived norm of being respectful of the environment, which, in turn, will strongly impact on the way in which an individual behaves and, therefore, how their environmental awareness is formed. In this way, the entire system can be strengthened and ever higher levels of sustainability achieved.

In addition, our environmental knowledge is a vital factor in identifying and enhancing the feedback loops which encourage more mature levels of sustainability. In a recent work [22], a model was proposed to accelerate transformation towards sustainability in complex systems such as universities. The model uses criteria to typify the actions and processes used in institutional learning [23,24], such as their starting direction and level. Two-directional actions and processes contribute to each other: on the one hand, there are the bottom-up processes from the individual to the organisational level, which form a kind of ‘feedforward’ which can strengthen environmental awareness on every level; on the other, the management reacts in a complementary, synergistic way, by conducting feedback on actions and processes arising from strategic commitments and decisions, which permeate all the structures and groups in a top-down direction, acting on the perceived norm.

1.2. Universities, Key Settings in Education for Sustainable Development

Many forums and statements see universities as a key setting for ESD [25,26]. Universities are a vital area where answers to the problems and challenges of the current and future society can arise [27]. In addition, they are an important agent of change for sustainability, as they train future professionals who will directly or indirectly influence their environment [28] through their knowledge, values and attitudes [29].

Universities, therefore, are bound to play a fundamental role in achieving the Sustainable Development Goals [30,31] and it is a vital challenge for them to seek ways of contributing to meeting the 2030 Agenda by setting a good example, and exploring further the scope for innovation in sustainability [32].

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) published in 2020 a document entitled 'Education for Sustainable Development: A Roadmap' [33], which presents five priority action areas in which the actors involved are encouraged to design activities (Figure 1).



Figure 1. UNESCO's Priority action areas of ESD for 2030 framework. Source: Authors' own.

The first of these, 'Advancing policy', explains how ESD should be integrated into global, regional, national and local policies related to education and sustainable development. To achieve this, it proposes steps such as integrating ESD into education policies or systematically strengthening the synergistic relationships between education and formal, non-formal and informal learning.

As regards the second priority action area, 'Transforming learning environments', the aim is for educational institutions to change so that the institution as a whole conforms to the principles of sustainable development. It suggests that this can be achieved, if these institutions, among other measures, ensure that their governance and culture comply with the principles of sustainable development, or that the technical and administrative staff

servicing the education sector ensure that their facilities and operations comply with the principles of sustainability.

One of the responses adopted by universities to meet the demand for more sustainable practices is to include scientific-technical environmental management structures, which act as a stabiliser, catalyst, facilitator, attractor and, to a great extent, the main actor in the organisation's desire for change, and which can be the prime mover in their evolution towards sustainability [22]. Many of these management structures know that one key condition for solving problems is that those who cause the problems change their behaviour and attitudes [34], and that ESD is integrated into their operational functions. By setting up such a framework which facilitates pro-environmental behaviour, it is more likely that the university community will take the message on board and act accordingly both in work and study places and in teaching and research settings, which are unique to universities.

In their desire to systematise this transformation towards sustainability, universities are increasingly bringing in accreditation systems for their environmental and sustainability programs, in the form of certificates, accreditation (AISHE, Le Plan Vert, LIFE Index) or ranking scales (GreenMetric, STARS, People and Planet) [35]. However, not many tools exist which facilitate the improvement and evaluation of environmental performance in the workplace. Among the few examples, there is an interesting case of Harvard University, which has launched its 'Green Office Program' [36] for good environmental practices in the university administration. Producing a versatile tool that is applicable to all types of areas (management, research and teaching), would be in line with the integrative philosophy of pro-environmental improvement in universities.

The third priority action area in the roadmap for ESD is linked to strengthening the skills of educators. The focus here is on empowering educators with the necessary knowledge, skills, values and attitudes for the transition to sustainability. The idea of 'curricular sustainability' is a key concept here: this process involves providing students with the transversal competences needed to understand how their professional activity interacts with society and the environment [37]. The inter-university working group set up to address this concept in the Conference of Rectors of Spanish Universities (CRUE), in which the authors of this article participate, has defined curricular sustainability as the process of incorporating criteria of sustainability into teaching and student learning, so that sustainability permeates all spheres of teaching, as well as the management systems involved [38]. Curricular sustainability is a good practice to be acquired, in this case mainly by the teaching community, hence the need to train them in this area [39]. The role of teachers and their teaching activity is therefore essential, and it would be coherent to state that actions aimed at teachers can result more directly in a faster transition [40] in young people, who should be recognised as key players in tackling problems of sustainability and the associated decision-making processes. Young people constitute an important priority action area, with whom the plan is to use all the available resources to share messages about the urgency of the challenges to achieve sustainability, to promote ESD in their educational environments and to encourage self-empowerment and transformative action.

The fifth and final priority area of action, relating to mobilising resources on a local level, emphasises the importance of actions on the part of communities, as it is here where meaningful transformative actions are most likely to take place. Active cooperation between educational institutions and the community should therefore be promoted to ensure that the latest knowledge and practices in sustainable development are implemented in order to advance the local agenda.

The roadmap marked by the UNESCO constitutes a good reference tool which can be applied by each university and adapted to their own particular context.

1.3. The Case of the University of Córdoba (Spain)

In the case of the University of Córdoba (Spain), referred to henceforth as UCO, the process of progressively including environmental sustainability in its policies, structures

and lines of action began two decades ago, with the aim of reducing its environmental impact while fulfilling its educational and social functions [41].

In the work mentioned above [22], the organisational model proposed arose from an analysis of the main environmental measures carried out in the UCO over the past 20 years, identifying the stages which can be detected in the process and the variables which come into play both at an individual and a group/administrative level. In this analysis, two particularly relevant steps were identified, in the area of mature, participative cycles of organisational learning [23,24] designed and run by the UCO's own scientific-technical structures for environmental management and education (the Environmental Protection Office 'SEPA', and the Sustainability Office), which have had a major impact on the evolution of sustainability processes at the UCO.

The first of these was the participatory Environmental Diagnosis and Action Plan, which was designed and run through a comprehensive, complex participatory process (explained in detail in [42]). In this scheme, the university community was involved in improving the environmental management of the institution as a whole, while working to create environmental awareness and to improve the environmental education of the participants. Representatives of all groups (government, students and staff) took part, reflecting, debating and prioritizing steps to improve environmental management.

The second was a result of key objectives selected by the participants in the previous process: the need for all areas of the university to adopt acceptable minimum standards in environmental matters in their daily work, and to establish mechanisms to give recognition to those in the areas of management, research and teaching who already meet the standards of commitment to environmental sustainability. Is it possible to develop a tool that meets this demand? Can such a tool comply with the principles and areas of action of ESD? Can it also comply with a model that aspires to combine environmental management and education effectively and practically to strengthen environmental awareness and reset the accepted norms? Can this tool help in the process of curricular sustainability?

2. Materials and Methods

Our research questions are: What requirements should a tool for environmental awareness and training towards good practices meet? What should be its design and structure? How can the effective adoption of good environmental practices be evaluated?

Therefore, the objective of the research is to design and develop our own system of certification of good practices in environmental sustainability for the university, as well as to propose an evaluation methodology.

We aimed to design a tool for certification and a procedure that would enable the university environmental management to be improved by further educating its members in the areas of management, teaching and research.

The study took place at UCO, over the academic years 2013/14 and 2019/20. The UCO university population at the beginning of the 2019/2020 academic year consisted of 16,079 students and 2745 staff. These were distributed over 10 centres belonging to the university and 1 affiliated centre, with 165 research teams spread over 65 departments and collaborations with 10 research institutes; it also had 17 professorships and 12 lecture halls, in addition to more than 30 support service units for management, teaching and research. It provided training for 31 undergraduate degrees, 45 master's degrees and 29 doctoral programs [43].

SEPA was responsible for the design and development of this system, as the university's environmental management and education authority.

2.1. Identifying the Basic Requirements

A consultation with experts was set up (six professionals from the fields of education and university environmental management) to detect what basic requirements or characteristics the tool and the procedure should have, in order to facilitate awareness and training for the effective adoption of good environmental practices. During a joint interview lasting

one hour, the panel of experts came to an agreement and classified their answers into the categories of 'motivation' and 'competence' for pro-environmental behaviour [19]. These requirements were used as premises for the subsequent phases:

In order to inspire motivation (the desire to participate), it was agreed that the tool and the process must be:

- Orientated towards improvement;
- Able to recognise efforts made;
- Original and pioneering;
- Enjoyable to do;
- Autonomous;
- Voluntary.

In order to encourage competence (the ability to participate), it was agreed that the tool and the process must be:

- Adaptable to different contexts and realities;
- Simple;
- Able to offer help and advice;
- Realistic;
- Free;
- Progressive;
- Verifiable.

2.2. Design and Validation of the Tool

The name 'Trébol Programme' (*'trébol' = 'clover' in Spanish*) was proposed, in reference to the different levels (or 'clover leaves') which are achieved as progress is made in improving environmental performance. First, a compilation of 78 good environmental practices was made, which were grouped into eight categories corresponding to the areas reflected in the commitment to UCO's environmental policy (energy, waste, consumption, transport, purchases, research, teaching and participation). In addition to these categories, three levels of complexity were also established, to permit a progression 'leaf by leaf' (of the clover) until all three levels were completed. The wording, complexity and scope of the items were designed to make them applicable and adaptable to any organisational unit and scale.

After an initial draft of the instrument was made, a panel of experts was set up to verify its scientific credentials. The panel, consisting of the six experts mentioned above, was informed about the objectives of the review and asked to assess the structure of the tool and its compliance with the basic requirements, how clearly each action was expressed and how suitable it was as a part of the instrument.

The initial draft was generally well-received, both in format and content. The following improvements were proposed and incorporated:

- Changing the category 'research' to 'laboratories', to facilitate understanding and ease of application.
- Adding one more level of complexity, to include actions aimed at measuring or estimating indicators (as a reflection of maturity in environmental performance before the environmental management systems were implemented), as well as items related to the SDGs, also as a previous step to implementing transversal strategies in the university's 2030 Agenda.
- Generating two specific, independent sections for each item: first, a description of how to put the item into practice and second, the availability of teaching aids.

Once these contributions had been added, the new version (with 89 items) was tested with an experimental group. Seven different units from the UCO were chosen (deanery, administrative service, scientific-technical service, research groups, etc.), and asked to collaborate to implement level 1 of the Trébol Programme and to carry out a subsequent

critical analysis of the certification tool and procedure. These contributions led to the following improvements:

- Addition of an initial category, with steps to initiate and organise the documentation effectively and communication channels between the members of the unit.
- Change of level of several items to match their difficulty of implementation.
- Combination of some items with similar ideas.
- Changes in the wording of certain items and their resources for greater clarity.

Once these improvements were made, the final instrument was published on the website www.uco.es/programatrebol. The final tool consisted of a list of 100 good environmental practices corresponding to eight categories of environmental areas, plus an additional category of planning, which were classified in turn into four levels of complexity. Table 1 shows the number of items by level and category:

Table 1. Distribution of items in the Trébol Programme by level and category. Source: Authors' own.

Category	Level				N° Items/ Category
	1	2	3	4	
General	8	4	4	3	19
Energy	4	4	2	3	13
Waste	4	2	1	1	8
Consumption	5	5	2	1	13
Transport	3	2	1	1	7
Purchases	3	2	1	2	8
Laboratory	3	2	2	2	9
Teaching	2	3	2	1	8
Participation	5	5	3	2	15
N° Items/Level	37	29	18	16	100

To give an example, Tables 2 and 3 show some of the items for each level in the categories of 'consumption' and 'teaching':

Table 2. Examples of good practices of the Trébol Programme in the category of 'consumption'. Source: Authors' own.

Level	Item
1	We use paper which has already been used on one side for making rough notes. The paper is kept in a place where all the members of the unit have access to it.
2	We reduce the margins on printed documents in order to print fewer pages.
3	We follow responsible practices of consumption in the activities or events we organise (classes, meetings, conferences, etc.), using digital documentation, recycled/eco-friendly materials and give-aways, eco-friendly/fair trade catering, etc.).
4	We regularly calculate or estimate our consumption of consumables (paper, toner and ink cartridges, etc.).

Table 3. Examples of good practices in the Trébol Programme in the category of 'Teaching'. Source: Authors' own.

Level	Item
1	Wherever possible, we make use of online platforms to communicate with the students, provide notes and class materials, return their work, reports, etc.
2	We are aware of the concept of 'a sustainable curriculum' and its possible applications.
3	We have analysed our teaching practice from the perspective of sustainability.
4	We have introduced sustainability criteria into our subjects, in content, methodologies, skills or evaluation.

2.3. Designing the Evaluation Process

The process requires continuous feedback from the participants, within a framework of facilitation and communication that permits the autonomous implementation of good environmental practices. First, SEPA can receive a request or propose an informative or motivational visit, as a step prior to joining the Trébol Programme. Any university department which opts to join must be inscribed on the website and the available resources, and must decide on the scope, person in charge, contact and the items to be applied. It must also obtain the commitment of at least 75% of its members, which represents a reasonable majority. These are the steps required prior to sending an official enrolment request, to which SEPA will respond with a welcome email, arranging an initial visit to explain the content of the program. SEPA and the university department will carry out a follow-up visit to assess the degree of implementation of the good practices, the difficulties and problems which may exist. When the department considers that the programme is in place, it will request the evaluation visit. Here, SEPA will gather evidence, using checklists, interviews and observation, on whether the Trébol Programme is being implemented properly and will draw up an evaluation report. If it detects any weak points or need for improvement, a proposed solution must be sent to SEPA. The department will then be certified with the corresponding level of the Trébol Programme, the certificate will be issued and the files will be issued on the use of the 'Trébol brand'. This certification is valid for two years, after which the department's performance must be re-evaluated at the level for which it was certified ('recertification'), or submit a new membership form to begin the next level. However, before those two years are over, the department can choose at any time to apply for certification for the next level of the Trébol Programme.

Table 4 summarises the main aspects of each visit, including the environmental education and communication actions used during the process:

Table 4. Description and objectives of environmental education associated with the Trébol Programme visits. Source: Authors' own.

Type of Visit	Description	Aim of Environmental Education
Motivational	Background, justification, objectives, benefits and procedure.	Activation of environmental awareness and motivation.
Initial	Planning for implementation. Explanation of the items and teaching material.	Learning how to use the tool, activation of competence
Follow-up	Follow-up interview with contact person and team to follow-up the process (difficulties, limitations, degree of achievement, etc.).	Checking the level of training for low-cost pro-environmental action and identification of high-cost measures.
Evaluation	Interview with contact person, random questions to department members and observation of premises to check each item is implemented properly, detection of strengths and areas for improvement.	Checking the level of training for low and high-cost pro-environmental actions.
Certification	Meeting with the department members unit for official photo and certificate award ceremony as recognition, which is publicised in the university community.	Reinforcement and assessment of newly acquired habits, skills and awareness.
Re-certification	Interview with contact person, random questions to department members and inspection of premises to check continued implementation of good practices, detection of strengths and areas for improvement.	Checking the effective acquisition of competencies for pro-environmental action.

At the same time, in order to obtain feedback on the participants' satisfaction with the programme and their perception of its effectiveness, strengths and weaknesses, a brief evaluation survey of the Trébol Programme was planned for certified departments or

those in the process of certification. It consists of four questions, two quantitative items with a closed Likert-style response about how applicable and useful they consider the initiative to be ('Do you think that the Trébol Programme is accessible for any department?'; 'Do you think it has resulted in an improvement in pro-environmental actions in your department?' and two other qualitative items about strengths and weaknesses ('What would you highlight as (a) strong point(s) of the Trébol Programme?'; 'What would you improve?'), were questions with an open-ended response; the replies were then analysed qualitatively, the information was recorded and a series of categories based on three statements was established.

In addition, it was considered of interest to measure the possible impact of the tool on teaching, and the indicators related to the commitment and action as part of the sustainable curriculum of teachers who participate in the Trébol Programme. A course aimed at university teachers on the introduction of sustainability in teaching which is held annually at the UCO was taken as the reference point, and the possible link between participation in this course and the Trébol Programme was studied, using the following indicators:

1. The number of students attending the course on introducing sustainability in teaching who also participate in the Trébol Programme.
2. The number of departments involved in the Trébol Programme which have a teacher who has participated in the introductory course on sustainability in teaching.
3. The number of departments certified or adhered to the Trébol Programme which have high levels of commitment to curricular sustainability (2, 3 and 4) and which have a teacher who participated in the introductory course on sustainability in teaching.

3. Results

From the outset in the 2013/2014 academic year until the end of 2019/2020 (when the data for this work were collected), 53 widely diverse 'units' (university departments or areas) have joined the programme (Table 5), of which 31 have now received certification (19 at level one, four at level two and eight at level three), in an average time of 6.8 months (range 1–14 months, SD = 4.233). In addition, another nine units are currently in the process of implantation of the first level of the Trébol Programme. Of the total number of units which began the enrolment process, 13 did not complete or renew the certification, which represents 24.5% (six did not complete the implementation process, six did not renew certification after completing their validity, and one did not pass the evaluation process)

Table 5. Participants in Trébol Programme in the academic years 2013/14 and 2019/20. Source: Authors' own.

Type of Unit	Implantation Status							N° Units	N° Participants
	A1 ¹	C1 ²	C1A2 ³	C2 ⁴	C2A3 ⁵	C3 ⁶	NC ⁷		
Administrative Teams			1					1	25
Deaneries	1	2				1		4	33
Administrative/Technical teams	4	8	2	1		4	6	25	212
Departments and sub-departments	1	3	1		1		1	7	135
Research Groups	3	2		1		3	3	12	112
Student councils/groups				1			3	4	73
N° Units	9	15	4	3	1	8	13	53	
N° Participants	67	169	92	29	18	72	143		590

¹ A1: Adherence level 1. ² C1: Certification level 1. ³ C1A2: Certification level 1 adherence level 2. ⁴ C2: Certification level 2. ⁵ C2A3: Certification level 2 Adherence level 3. ⁶ C3: Certification level 3. ⁷ NC: Did not continue.

The total participation during the study period was 590 individuals, of which 73 were students and 517 staff (18.9% of the total UCO staff). To date, there have been 87 enrolments and 57 evaluation processes to obtain certification (Figure 2).

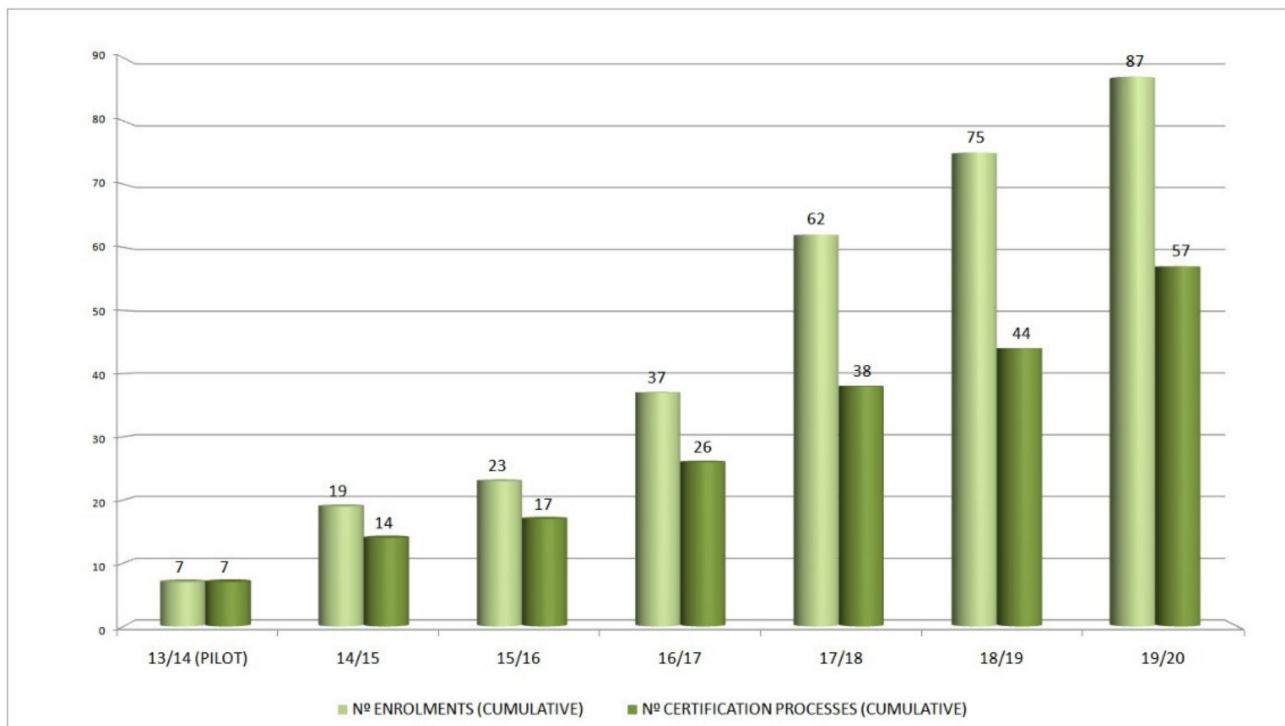


Figure 2. Evolution of enrolments and certification processes in the Trébol Programme. Source: Authors' own.

As regards the participants' feedback on satisfaction and perception of the effectiveness of the tool, the evaluation survey mentioned in the previous section was sent to the 31 certified units, and 12 of them responded (38.7%). The data obtained are shown in Table 6:

Table 6. Categories and evaluation of the feedback questionnaire. Source: Authors' own.

Item	Type of Response	Assessment
Do you think the Trébol Programme is accessible to any unit?	Closed (Likert-type scale 1–5)	4.43 (DS = 0.852)
Do you think it has resulted in an improvement in the pro-environmental action in your unit?	Closed (Likert-type scale 1–5)	4.43 (DS = 0.646)
What would you say were the strengths of the Trébol Programme?	Open	<ul style="list-style-type: none"> -An effective tool for environmental improvement (6 mentions) (<i>'The organisation and planning are based on clear guidelines for environmental improvement.'</i>) -Strengthening of environmental awareness (5) (<i>'You start to realise that, with a few small changes, you are encouraging positive practices which help you contribute to improving environmental practices. These apply not just to work but also to your daily life'</i>) -Educational resource (2) (<i>'It's highly didactic'</i>) -Competencies of the team managing the programme (1) (<i>'The initiative and motivation of the staff'</i>)

Table 6. Cont.

Item	Type of Response	Assessment
What would you improve about the Trébol Programme?	Open	-More information/awareness-raising (4 mentions) (<i>'Provide more information (news, advice, expand topics, etc.)'</i>)
		-Make it more generalised/obligatory (2) (<i>'Generalising and extending the programme to all services; some of the items could be made obligatory in University departments'</i>)
		-Simplification of the procedure (2) (<i>'It needs to be simpler to implement it properly'</i>)
		-More communication between units (1) (<i>'It could be good to have a meeting of the different units at which common themes are discussed'</i>)

Finally, the following results were obtained from the indicators for measuring the possible impact of the tool on teaching, as regards the commitment and action with the curricular sustainability of the teachers who participate in the Trébol Programme:

1. Percentage of students in the introductory course on sustainability in teaching who were also participants in the Trébol Programme: 22.7% (23 out of the 101 participants in the last six editions of the teaching course 'Introduction to sustainability in teaching').
2. Percentage of units enrolled in the Trébol Programme which have a teacher who has participated in the introductory course on sustainability in teaching: 66.6% (16 out of 24 units enrolled which had teaching departments, research groups, deaneries, a governing body etc., had a teacher who had completed the course).
3. Percentage of units enrolled in the Trébol Programme or those certified at levels of high commitment to curricular sustainability (2, 3 and 4) which have a teacher who has participated in the introductory course on sustainability in teaching: 100% (there was a teacher who had completed the course in all nine units which were enrolled or certified at level 2 upwards and which had teaching staff).

4. Discussion

The current relationship between humans and the environment has led to an unprecedented crisis in the system [44]. But behind it lies a crisis of knowledge based on economic models which seek unconstrained development with little regard for the constraints of the biosphere [45].

In this era of crisis and global change [46], all organisations must relate to the ecological and social context that surrounds them, as well as to the remodelling of and fluctuations in the economy. These changes, rather than an obstacle, should be seen as an incentive to continue increasing the sustainability of our actions. Participation is an essential tool to lead these organisations forward in the context of global change in which sustainability has become the key for bringing about the necessary transformations.

However, it would be simplistic to state that the solutions to the problems of sustainability basically depend on the technological advances, because most of the dilemmas to be solved are ethical, political and educational [47]. Therefore, to advance towards the goal of sustainability, it is the peoples' attitudes and behaviour which must change, through education for sustainable development (ESD), which aims to strengthen environmental awareness and develop 'training for action' [48], while at the same time strengthening the perceived norm of respect for the environment. Progress towards this goal depends largely on the training, awareness and involvement of citizens [49].

The 2030 Agenda for Sustainable Development is not just an obligation—it provides an opportunity to respond to the world's challenges, and here, universities are key actors for change [50]. Universities around the world have made huge efforts to incorporate

sustainability in different areas, to varying extents and with different degrees of success [51]. The initial reference points are, obviously, the priority action areas identified in the roadmap for ESD established by the UNESCO [33]. The Trébol Programme, the tool presented in this work, directly promotes two of these priority areas of action (Area 2, related to the transformation of learning environments and Area 3, on the training of educators) and relates closely to the other areas.

In this context, driven by the previous failures of purely ‘top-down’ approaches, there is a growing trend towards ‘bottom-up’ participation [52]: in this case, giving the university community more say in decision-making and co-responsibility. This enhances the joint action of the individual and the community, with both interrelated spheres acting on environmental awareness and the perceived norm to impulse the processes of sustainability. The work presented here shows an example of this new kind of participation, and constitutes an effective tool to improve university environmental management through the education and action of its members, in line with the UNESCO’s challenge to search for transformative learning environments. This approach also makes it possible to strengthen the local connection of the participants in this initiative in the face of global challenges and problems.

Indeed, the UCO is well aware of the environmental consequences of its activity, and of its responsibility as a higher education institution to bring its policies, strategies, structures and activities of the institution in line with the 2030 Agenda and ESD [53]. Like many other similar institutions, it has initiated a gradual process of introducing environmentally friendly policies, working through specific organisations bodies, like the Environmental Protection Office (SEPA) or the Sustainability Office. The Trébol Programme developed by these bodies allows us to put into practice the commitment set out in the UCO’s environmental policy, through continuous, comprehensive, systematised, participative and organised improvement of environmental performance. As one participant put it: ‘We found the Trébol Programme the perfect tool for improving our commitment to environmentally friendly action’. The different levels and themes provide a roadmap which facilitates the natural progress through the increasingly complex spheres of action, and avoids any possible burnout by trying to reach the objectives straightaway, or by attempting to cover the entire spectrum at the same time. It also provides a framework giving access to new information and knowledge. One example is the area of teaching, which promotes a progressive approach to the concept and principles of curricular sustainability, thus allowing time for in-depth reflection about teaching from the perspective of sustainability [37]. The results also seem to show that the Trébol Programme allows targets to be reached sooner in this priority area of action for ESD, as there is a close correlation between the teachers who participate in the Trébol Programme and those who also attend training on how to introduce sustainability in teaching. It is particularly relevant that all the units that adhered to the programme or were certified at levels of high commitment to curricular sustainability contained teachers who had attended this course. Teacher training within the framework of ESD is a key tool to advance towards sustainability in universities and in society in general, so much so that we believe that it could be an indicator of SDG 4 to assess the contribution of universities to the 2030 Agenda. In this sense, an initiative such as the Trébol Programme can help contribute to this goal. Complementarily, universities should not leave behind the transformation of learning environments in educational institutions, which should ensure that their entire organisational culture and management are consistent with the principles of sustainable development that they intend to convey [33].

An added value of this holistic, integrative approach to environmental improvement is recognition through a standardised certification. This meets the demand from the university community for a mechanism to reward the effort of those who work towards pro-environmental criteria, as well as providing a protocol that guarantees that acceptable minimums in environmental matters will be met in our daily work [42]. Besides helping to create networks within the university community, promoting sustainability in teaching, research and university management, it is also a flexible tool that can be adapted to other

settings apart from universities to increase their commitment to manage responsibly the environmental matters [37]. In this context of extending action by the university to the wider community, the Spanish Network for Sustainable Development-REDS [54] recently included the Trébol Programme in a dossier of inspiring cases of the contribution to the 2030 Agenda in the Spanish higher education system. In addition, several universities and organisations have shown interest in adapting the UCO's Trébol Programme to their own context, as is the case of IMIBIC (Maimonides Institute for Biomedical Research of Córdoba), or the University of Deusto, which has launched a similar programme called Haritza [55].

In addition to its adaptability to other organisations, the Trébol Programme also provides a tool which is applicable to other settings and contexts. Take the case of the environmental implications of daily activities in our homes. Here, it is worth highlighting the adaptation of the initiative carried out during the Covid-19 lockdown period called the 'Trébol Home Programme' [56] in which the SEPA and the Sustainability Office launched a campaign on social media to give recommendations and good practices to minimise our environmental impact at home. The main message conveyed was that we should take advantage of this time spent at home to adopt pro-environmental behaviour, so that when the lockdown is over, our position will be stronger and everyone will benefit.

As mentioned above, the participants in the Trébol Programme have stressed the potential of the tool as an educational resource for environmental improvement through raising environmental awareness, which is consistent with the objectives pursued by ESD [16]: to raise citizens' awareness and get them to carry out pro-environmental action. Along these lines, the design of the Trébol Programme has sought to create a positive scenario to provide the motivation and competence necessary to carry out pro-environmental behaviour [19], taking advantage of the use of digital resources. It enables us to improve environmental awareness, information and management through a participatory facilitating process, designed to be attractive, simple and rewarding (one of the participants stated that 'this project has made us more aware that if everyone does their bit, great things can be achieved for the environment'.)

After five academic years, the participation rate has increased dramatically, with almost 19% involvement among the UCO staff. The level of satisfaction of the participants of the Trébol Programme is high, with values over 4.4 out of 5 for both ease of application and usefulness for environmental improvement. This vocation of adaptability to any organisational unit and scale can be seen in the wide range of units which have taken part (administrative, technical and management services, research groups, departments, student councils, etc.), as well as the significant participation of the university's governing bodies (Rector, Vice-Rectors and Secretaries, as well as several deaneries). This commitment of the governing bodies is crucial, since, as Ryan [57] states, the continuity and success of this type of process require both the continuous support of government structures which can deal with its complex procedures and an active community with a high level of commitment (one of the participants states 'it gives us a huge feeling of pride and satisfaction that we can manage our resources responsibly in order to achieve greater environmental sustainability, and that this is valued and supported by the University').

As regards the main areas for improvement, the participants mentioned strengthening information and awareness-raising actions, the possibility of making some aspects generalised or obligatory, and the simplification of the procedure. These issues may have led to one of the main limitations of the study, which is the slow implementation period in some cases, due to the fact that each unit sets its own pace (the average implantation time is of 6.8 months, although there is a wide range from under a month to over a year). This means the SEPA has sometimes had to play a more active role than initially foreseen in setting the process in motion.

Another limitation detected is the existence of some units that do not continue with the process (13 out of 53 to date), either because they do not complete the implementation process or because they do not renew the certificate. This latter situation often happens

in units made up of student groups, because they only belong to the university for a few years, which means that burden of maintaining the programme falls on individuals rather than on the unit as a group. To address this, given the interest that students spontaneously show in the Trébol Programme, and within the framework of the priority action area set by UNESCO for ESD [33] regarding the empowerment and mobilisation of youth, we are already working on a future plan to design and develop a tool to adapt the Trébol Programme to improve and recognise the environmental commitment and action of these student groups.

For future lines of research, we plan to set up a continuous process of data collection to analyse the usefulness of the Trébol Programme as a tool to strengthen the effective pro-environmental behaviour in the medium and long term. To achieve this, we would identify and categorise the difficulty, cost and effort involved in applying the range of good practices. In addition, we aim to continue strengthening the links between education and management using specific evaluation tools.

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