



Article

Learning about Sustainability and SDG with Future Primary Education Teachers in Initial Training

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Abstract: The current situation of global change, caused by our way of life and our consumption habits, has negative effects on the social, economic and environmental spheres. To alleviate these changes, from the field of education, various actions focused on sustainability are being carried out. Knowledge of sustainable environmental development is essential in the formation of citizenship, and therefore in education. That is why the purpose of this work is to introduce future primary school teachers to the Sustainable Development Goals (SDG) of the 2030 Agenda for Sustainable Development established by the UN, as an educational tool for teaching and learning sustainability in classrooms. The 4th Degree of Primary Education students worked at designing a didactic intervention, based on the development of Education for Sustainable Development Competencies (ESDC), complemented with the dissemination on Instagram of visual creations on the SDGs designed for primary education students. As a result, 5 didactic proposals and 84 posts were generated on Instagram with 1131 comments. In conclusion, in teacher training, it is necessary to become familiar with the scientific contents and the various ways of working on them in the classroom, to enable the necessary didactic transfer.



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1. Introduction

The world in the process of global change is a world in which the unequal exploitation and use of resources causes inequalities and imbalances in all spheres: social, economic and environmental. The current situation of global change, caused by our way of life and our consumption habits, has effects on all terrestrial systems (atmosphere, geosphere, hydrosphere and biosphere). It is argued by (Saldaña and Messina 2014), that current societies manifest a series of values and norms of conduct that have been developed along with economic development, and that have caused a change in lifestyle; the main causes by which the environment in the world continues to deteriorate, the unsustainable patterns of consumption and production. This change of anthropic origin has various faces, such as accelerated climate change, the loss of biodiversity, the unequal distribution of water and food, the overexploitation of natural resources, the loss of functionality of ecosystems, etc. (Acevedo et al. 2018).

The human being, aware of these facts, has been adopting measures and promoting initiatives both at the international and local levels to alleviate the negative effects of these changes that not only affect the environment, but also interfere with the social and economic spheres. One of these changes has been taking place in the field of education, through the integral formation of the person with special attention to sustainability, which requires a sensitivity and a special awareness of the environment, to understand it as an ecosystem and habitat that welcomes us and that must be cared for, cared for and conserved (Hernández 2019).

Since the 1970s, the UN has launched various international conferences and agreements of various kinds with the aim of reducing and eradicating inequalities and seeking environmental balance (UNESCO 1980). Among others, we can mention the United Nations

Conference on the Human Environment or Stockholm Conference (1972), the Tbilisi Intergovernmental Conference on Environmental Education (1977); the United Nations Conference on Environment and Development, also known as the Earth Summit, was held in Rio de Janeiro, Brazil, from 3–14 June 1992; the United Nations Decade of Education for Sustainable Development (2005–2014) or the Millennium Development Goals (2000–2015) (UNESCO 1994, 2020).

Future primary education teachers must know and deepen the current development agenda, heir to the Millennium Development Goals, called the Sustainable Development Goals (SDG). The SDGs constitute an ambitious global sustainability agenda whose development was planned to begin in 2015 and conclude in 2030. The architecture of the SDGs is structured around three dimensions (economic, social and environmental). The purpose of this new development agenda is, to achieve sustainable development through the improvement of aspects such as education, equality, the eradication of poverty or the improvement of the environment (Labrador and del Valle 1995; González and Arias 2009).

Environmental education (EE), according to the successful definition established in the Moscow International Congress on Education and Training of Personnel related to the Environment (1987), can be understood as the permanent process in which individuals and communities acquire awareness of their environment and acquire the knowledge, values, skills, experience and also the determination that enables them to act individually and collectively in the resolution of present and future environmental problems (Martínez 2010; Novo and Murga 2010).

The main international antecedent of environmental education probably lies in the First UN Conference on the Environment, held in Stockholm (Sweden) in 1972, where the anthropic origin of environmental conflicts is recognized (Otero 2000). The beginning of the international Environmental Education program took place only five years later, at the First Intergovernmental Conference on Environmental Education, held in 1977 in Tbilisi (Georgia). In it, three main learning objectives can be highlighted, as follows: (i) to make the natural system known, (ii) to teach to evaluate the interrelation with society and (iii) to promote an attitudinal change (Ramos et al. 2018).

Since its inception, environmental education has contributed to the generalization of conceptual knowledge of the functioning of natural systems and, in many cases, to the evaluation of the interrelationships of anthropic activity with other elements of the system (Báez 2016). Emphasis has been placed on the transnational dimension of environmental problems and the need for a comprehensive, coherent and coordinated educational effort around the world (UN 2012). The UN itself incorporated environmental education into its activity, through the UNESCO-UNEP International Environmental Education Program (UN 1987, 2011).

In 1987, the publication of the well-known Brundtland Commission Report, *Our Common Future*, led to the term sustainable development (Robles et al. 2021). By this it is understood, that social and economic developments that consider the different environmental factors, while still allowing the development of current society without compromising the development of future societies (Gonzalo et al. 2017). For this reason, the objective was established to make education the main instrument that facilitates transformation to achieve a sustainable future (Vilches and Gil 2012).

Although the international community openly recognizes the relevance of education as an instrument to implement the transition towards sustainability, little progress has been made to include this idea in the educational system. It is of little use to recognize the importance of sustainability if educational subjects do not incorporate it in their study plans or if teachers do not incorporate it in their classes (Solano 2008; Gil-Pérez and Vilches 2017). This situation becomes even more serious if we consider what (González et al. 2020) point out, that without sustainability there is no possible development, and for this to exist, education is necessary; two rights, to development and to education, fundamental to people's lives (Caride 2017; Vlasjuk and Mayer 2016; Wals 2009).

For this reason, knowledge of the essential aspects of sustainable environmental development is fundamental in the formation of citizenship, and therefore in the education of students (Fernández et al. 2021a). In this sense, it is necessary to consider the need to reinforce the training of future teachers in *Knowledge of the Didactic Content* (García and Martín 2016), in its multiple dimensions, such as difficulties in learning and teaching, in methodological strategies and in the characteristics of the students (Vallejo et al. 2013) and, in particular, to recognize that their training in environmental and sustainable aspects are fundamental for the formation of the citizens of the 21st century (Eusebio and Mendoza 2007; Álvarez-Otero and Lázaro-Torres 2018; Biasutti 2015). This education depends on elements such as the study plan, the curricular programs, the texts that are worked on, the didactic materials, the means and the equipment and infrastructures, among others (Vásquez et al. 2020). However, the work that teachers carry out in this regard and the importance of their training is fundamental (Calero-Llinares et al. 2019).

Thus, it is at this crossroads between education and sustainable development where what we have already called ESD (Spring 2001) arises, but the SDGs can also be implemented, since these objectives allow students to have a frame of reference to assess the sustainability of the environment (Gómez-Ruiz et al. 2021) and keep in mind an explicit horizon towards which to direct its moral motivation action, be it conservation or, mainly, prevention and rectification (Ortega 2020; Ortega-Ruiz 2009). In the current paradigm of climate and environmental emergency, sustainable development is the ultimate and urgent goal of any territory, and this must be well assumed, seeking curricular sustainability (Álvarez-Otero and Lázaro-Torres 2018).

The didactic use of the SDGs (UN 2015) is related to the constructivist paradigm of learning, according to which the students create new knowledge starting from their previous years, with the teacher's guidance and through active methodologies that help them develop a competency for learning with objects of study conceived as close to each other that increase the significance of learning and motivation (Sutinen 2008). This knowledge will be interdisciplinary (Biasutti et al. 2019) and will have a conceptual, procedural and attitudinal dimension (Biasutti and Frate 2017), as a basis for learning skills. Under this framework, teacher training, like any university degree in the European Higher Education Area (EHEA), is based on the acquisition of skills and abilities (Amor and Serrano-Rodríguez 2019). In its success, the development of didactic innovations through good educational practices acquires great importance (Zabalza 2012). This research is based on an example around landscape education with teachers in training.

From this perspective, the training of teachers in accordance with the principles of education for sustainable development (ESD) (Andić 2020; Suryanda et al. 2020) is established as a priority for the coming years, and thus guarantees that all students acquire theoretical and practical knowledge necessary to promote sustainable development and the SDGs (Canaza-Choque 2019; Biasutti et al. 2018).

2. Materials and Methods

2.1. Aims of This Work

The main aim of the study was to ensure the Sustainable Development Goals (SDG) are known to future primary education teachers as a tool for teaching and learning sustainability in primary classrooms. Additionally, this is concentered in these specific objectives:

- Objective 1. Work on sustainability in the primary education classroom by designing activities that address current problems and solutions, which are close to the community.
- Objective 2. Promote diverse values and attitudes of respect and cultural knowledge related to sustainable development.

2.2. Competencies

The inclusion of competences in higher education within the European area, through the ECTS credit system, has made it possible to create common points of reference and convergence (Cebrián and Junyent 2014). Through the work carried out linked to this study, it has allowed the development of different generic competences, from the ability to learn to the ability to improve performance and learning, including the development of study and research skills, among other capabilities. However, not only are these general competences developed, but competencies related to the area of education sciences are developed (analyze educational concepts and theories and educational policy issues in a systematic way; identify potential links between knowledge and its application to educational policies and contexts; recognize the diversity of students and the complexities of the learning process; know the different contexts in which learning can occur and the different roles of those who participate in the learning process; conduct educational research in different contexts; evaluate educational programs and materials; anticipate new educational needs and demands; be competent in various teaching/learning strategies; know the subject to be taught; be aware of the need for continuous professional development; respond to diverse needs of students; adapt the curriculum to a specific educational context) (Fernández-Fejoo and Pino-Juste 2016; Mellado et al. 2014; Robles-Moral and Fernández-Díaz 2021).

On the other hand, several authors (Cebrián and Junyent 2014; Vukelić et al. 2019) have determined a theoretical framework of ESD professional competencies (ESDC) and elaborated some key components (Cebrián and Junyent 2015):

- ESDC1. Understanding the different scenarios, possible futures, promoting work with different visions and scenarios for alternative and future changes;
- ESDC2. Considering the different dimensions of a problem or action, the spatial dimension (local-global) and the temporal dimension (past, present and future);
- ESDC3. The ability to identify and connect the ecological, economic and social dimensions of problems;
- ESDC4. Generate the conditions for systems thinking in the school environment;
- ESDC5. Creating the conditions for critical thinking to question assumptions and to recognize and respect different trends and views in different situations;
- ESDC6. Moving from awareness to action, sharing responsibilities and engaging in joint action;
- ESDC7. Values clarification and strengthening behavior towards sustainability thinking, mutual respect and understanding of other values;
- ESDC8. Developing teaching and learning approaches based on innovation and interdisciplinarity;
- ESDC9. Promoting reflection on one's own emotions and as a means to reach a deeper understanding of problems and situations.

2.3. Participants

The research was implemented with 46 degree of primary education students (ISEN-University Centre, Spain). The students' mean age was 21.7 years ($SD = 0.66$) and the female gender was dominant within the sample (68.70%). All participants were studying the compulsory subject 'Nature Workshop' (3 ECTS credits) in 4th grade.

Participating 4th-grade teachers in training were grouped into 5 small work teams (8–10 people). Previously, participants were informed about this research and all of them gave their approval.

2.4. Intervention Programmed

For the design of the intervention programmed, the problem-based learning approach was identified as a valuable didactic strategy, since it allows students to explore real situations—in this case, related to sustainability.

For the design of the activity, it is necessary to respond to the structure studied and learned throughout the degree, establishing, among other issues: target course, workshop title, learning objectives, content to be addressed (both conceptual, procedural and values), curricular framing, competences, explanation and development of the activity, necessary resources for the development, timing, evaluation system and other aspects that are considered necessary.

The work will be carried out by working groups, made up of 8–10 people, and their work will consist of preparing a dossier where they explain their workshop or sequence of activities on the SDGs. Additionally, the activity will be valued based on its adequacy to what is required, its written linguistic correction, public presentation and compliance with delivery deadlines.

For the analysis and subsequent evaluation of the didactic proposals elaborated by the students of the degree, the tool developed in Table 1 will be used. This table was adapted from the work of (Fernández et al. 2021b; Pro and Robles 2020). This tool analyzes the different aspects that students have to take into account when designing their didactic proposals, but it allows quantifying of each of the aspects (0–4) to finally be able to give a score to the proposals between 0 and 40 points, the failure score being between 0 and 19 points, and the passing grade when the total score is equal to or greater than 20 points in said tool, since the minimum necessary aspects that are required will have been covered.

Table 1. Analysis and evaluation tool of the students' didactic proposals. Adapted (Fernández et al. 2021b; Pro and Robles 2020).

Item	Assessment				
	0	1	2	3	4
Title	There are not	Generic title	Correct title	The title is correct and attractive	It is attractive and motivating
Thematic	Not specified	A very general theme is established	A generic theme is established within sustainability and SDG	The choice of the theme is specified	The choice of the theme is specified and justified
Learning objectives	Not established	Some objectives are determined	All objectives are determined, but not developed	Some objectives are determined and developed	All objectives are determined and developed
Contents to be addressed	Not determined	Only concepts are determined	Concepts and procedures are determined	Procedures and attitudes are determined	Concepts, procedures and attitudes are determined
Curricular framing	No curricular element is developed	Some curricular elements are named	Curriculum elements are named, but not developed	All the curricular elements are named but some are developed	All curricular elements are named and developed
Sustainability competences	Not developed	They are named	They are named, but the description is very simple	Short and simple development	Developed correctly
Explanation and development of the activity	No explanation	There is a very vague explanation	Explanation is regular	Good explanation	The explanation is detailed and exact
Necessary resources	Not indicated	Some resources are indicated	All resources are listed, but not classified	All resources are listed, but only some are classified	All resources are listed and classified
Timing	Not established	An approximation is indicated	The timing is random	The timing is adequate	An adequate and realistic timing is established
Evaluation system	Not determined	Some evaluative elements are determined	All evaluative elements are determined, but not developed	Some of the evaluative elements are determined and developed	All the evaluative elements are determined and developed

In addition, the students were requested to complete the activity with the interaction of social networks, in this case Instagram. To do this, they had to upload explanations of different SDGs to Instagram, generating their own images or presentations in order that primary school children could understand them. As an element of follow-up and dissemination of the publications and a subsequent evaluation of the publications made, the hashtag #talleresnaturalezasostenibilidad2021 was created.

3. Results

3.1. Didactic Proposal

After the work was carried out by future primary school teachers, their didactic proposals yielded the data reflected in Table 2. In addition, this table shows the total scores and the means of both teams and item, in addition to the SD of each item and equipment. At a general level, according to the established range of achievement, or not, of the items, no item obtained a score lower than 50% of the possible points, with three items ('Thematic', 'Explanation and development of the activity' and 'Necessary resources') obtaining the maximum score of 17 out of a possible 20 points, that is, 85% of the score. While the item 'Title' is the one with the lowest score with 12 points (60%). Regarding the teams, all obtained a passing score, since they obtained a score higher than 20 points. Team 2 obtained the highest score with a rating of 36 points out of 40 possible, but teams 4 and 5 scored 23 and 24 points, respectively, with their scores being the lowest of the five teams.

Table 2. Results of analysis and evaluation didactic proposal.

Items	Team					Total	Average	SD
	1	2	3	4	5			
Title	2	3	3	2	2	12	2.4	0.5
Thematic	3	4	4	3	3	17	3.4	0.5
Learning objectives	2	4	2	2	3	13	2.6	0.8
Contents to be addressed	3	4	3	2	2	14	2.8	0.8
Curricular framing	3	4	3	2	2	14	2.8	0.8
ESDC	2	3	2	2	2	11	2.2	0.4
Explanation and development of the activity	3	4	4	3	3	17	3.4	0.5
Necessary resources	3	4	4	3	3	17	3.4	0.5
Timing	3	3	4	2	2	14	2.8	0.8
Evaluation system	3	3	3	2	2	13	2.6	0.5
Total	27	36	32	23	24			
Average	2.7	3.6	3.2	2.3	2.4			
SD	0.4	0.5	0.8	0.4	0.5			

When working on the different SDGs, the different work teams selected a specific SDG, and from the different targets established for each SDG they chose the most appropriate for the activity they wanted to design and the established didactic objectives. As can be seen in Table 3, the different teams selected two targets per SDG, except for team 5, which decided to work on a single target, and this has had an impact on the design of its didactic proposal, which was not as elaborate as the rest of the teams. Furthermore, it is noteworthy that two teams agreed when selecting the SDG, but not on the specific targets, which were different from each other, with team 2 focusing on the sustainable generation of products, while team 4 focused on social awareness about sustainable production, management and consumption.

Table 3. SDGs and targets worked by the different work teams.

Team	SDGs	Targets
1	G7: Affordable and Clean Energy	7.2 By 2030, substantially increase the share of renewable energy in the global energy mix. 7.A By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
2	G12: Responsible Consumption and Production	12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. 12.6. Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.
3	G6: Clean Water and Sanitation	6.3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally. 6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.
4	G12: Responsible Consumption and Production	12.2. By 2030, achieve the sustainable management and efficient use of natural resources. 12.8. By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.
5	G4: Quality Education	4.1. By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and goal-4 effective learning outcomes.

With respect to ESDC, students did not directly reflect these skills but they can be extracted from the analysis of the activities they proposed. The most studied sustainable competencies in the different works were 'Moving from awareness to action, sharing responsibilities and engaging in joint action' (ESDC6) and 'Developing teaching and learning approaches based on innovation and interdisciplinarity' (ESDC8), being present in 80% of the works presented. However, the sustainability competences that were not present in any of the studies were 'Considering the different dimensions of a problem or action, the spatial dimension (local-global) and the temporal dimension (past, present and future)' (ESDC2) and 'Promoting reflection on one's own emotions and as a means to reach a deeper understanding of problems and situations' (ESDC9). The ESDC9, being an item of a personal nature and self-assessment of personal emotions, was not chosen by any team for presenting great complexity when working on social networks.

In addition, as can be seen in Figure 1, team 1 and team 5 were the teams that worked the most for ESDC, with 7 and 6 of the 9 established ESDCs that each team worked on, respectively; and the team with the least ESDCs was team 4 that only worked on one ESDC, since the students who made up this team recognized that they did not correctly understand the activity to be carried out, and when they correctly understood the task to be carried out, they were near the end of the established deadline to carry out the work.

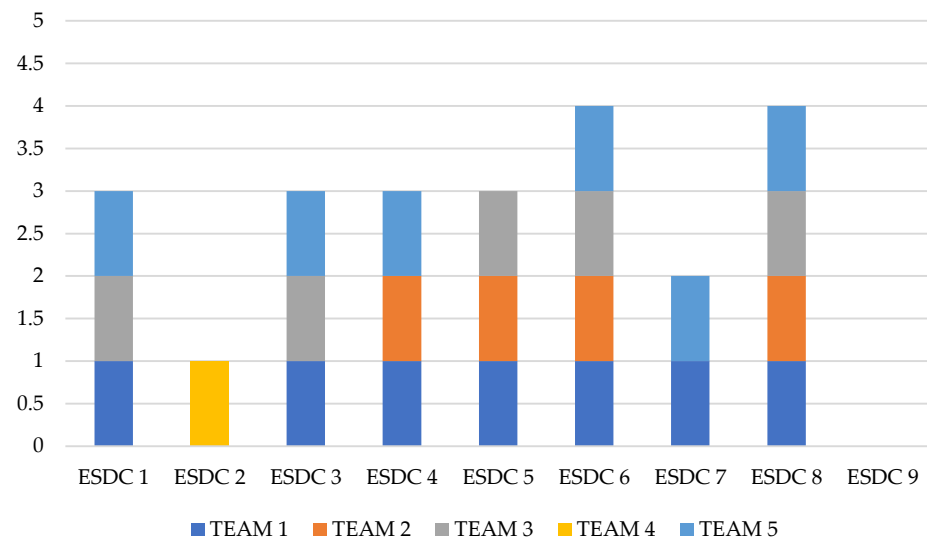


Figure 1. Accumulate graph of ESDC developed by each work team in their didactic proposals.

3.2. Instagram Results

The students worked for 15 days on the theme of sustainability and SDGs. Additionally, during this time, the working groups made 24 publications in total. Of these publications, as can be seen in Table 4, 84 posts were generated, with a response from more than 1100 people, in other words, 1131 likes and 67 comments were obtained.

Table 4. Results of students’ posts on Instagram about SDGs.

Publications	Posts	Images	Animations	Videos	Likes	Comments
A	10	10	0	0	64	3
B	6	6	0	0	26	3
C	1	1	0	0	45	1
D	1	1	0	0	33	2
E	7	5	0	2	52	2
F	8	8	0	0	27	1
G	1	1	0	0	37	1
H	1	1	0	0	35	1
I	1	1	0	0	35	4
J	9	9	0	0	36	4
K	1	1	0	0	18	1
L	7	5	2	0	32	4
M	1	1	0	0	97	19
N	1	1	0	0	50	6
O	1	1	0	0	56	4
P	3	3	0	0	98	2
Q	3	3	0	0	22	0
R	1	1	0	0	48	0
S	1	1	0	0	47	0
T	2	2	0	0	75	4
U	2	2	0	0	71	2
V	9	9	0	0	37	2
W	5	5	0	0	70	1
X	2	1	1	0	20	0
Total	24	84	3	2	1131	67

In descriptive statistics, the average number of posts per group was 4.8, with an average of 3.5 posts per post. The majority of publications being static images. In addition, each publication had an average impact of 47 likes and 3 comments.

Regarding the type of posts generated by the students, it should be remembered that Instagram is a social network based on photography, but this can be retouched to create static images, or generate animated images, or even adding videos of short duration. Thus, as can be seen in Figure 2, the type of posts generated by the different work groups were mainly images, with an average of 3 static images per post, compared to averages lower than 1 for the animated images or animations (0.12) and videos (0.08).

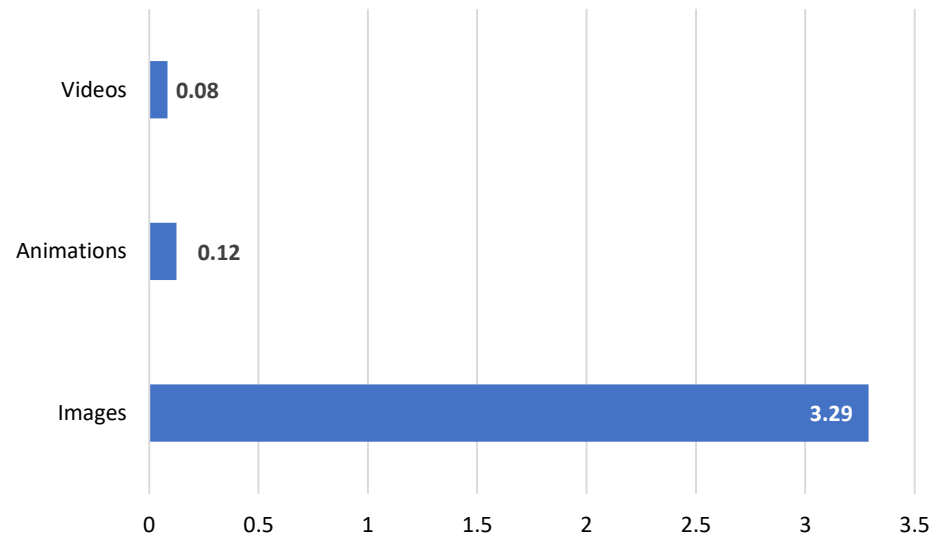


Figure 2. Graph of the average of type of posts generated by the students.

As an example of the images generated by the groups of students, Figure 3 shows two posts from one of the working groups. Although it is in the students' mother tongue, what SDGs are and what they consist of can be observed, as they are approached in an attractive way for future primary schoolchildren, using bright colors, a simple and understandable language and combining effectively the text with the images.



Figure 3. Example of images used by the students on Instagram.

4. Discussion and Conclusions

In relation to the scientific content of a socio-environmental nature, it was observed that the students addressed a wide variety of topics, all of them related to the causes and consequences of changes of anthropic origin, such as those pointed out by (Acevedo et al. 2018). Thus, it can be stated that the participating students were already acquiring the necessary knowledge to promote sustainable development, in line with the proposal of (Vásquez et al. 2020). However, in these topics, the use of examples closest to university students, such as the environmental consequences of the textile industry, sustainable food or the consumption of plastics, stand out.

Another aspect is essential in the training of teachers, to become familiar with the scientific content and the various ways of incorporating them in the classroom; for this reason, they need to acquire a well-structured and hierarchical learning to later enable an adequate didactic transfer to their future students (Garello and Rinaudo 2013). For this reason, pedagogical tasks should be added that allow consolidating of the didactic effectiveness of the different proposals to help achieve this goal (Toma et al. 2017).

Regarding the use of Instagram in the work developed by the students, although it was one more resource that was available to the students, for them seeing the impact that they could have when developing this work allowed them to become aware of the different aspects and uses that social networks can offer, of which, educational and informative use stand out. In addition, although the number of likes received is not an objective measure to measure the impact or influence on the knowledge of the people who saw the publications, if it is true, it provides an idea of the importance that disclosure can have on social media platforms such as Instagram. Of the comments that people wrote in the publications, an example was the following comment “Thank you very much for the information in a single image, you can say a lot”.

With regard to the professional competences of ESD, it has been observed that, although these competences are important in scientific education, future teachers give more importance to the competences established in the current educational legislation (González and Arias 2009; García-Esteban and Murga-Menoyo 2015), compared to those transversal competences found in the hidden curriculum (Colon 2016; Biasutti et al. 2016).

In short, the scientific-didactic study of sustainability makes it possible to assess the degree and incidence of its socio-environmental (im-)balance, questioning its state of adjustment to the characteristics of sustainable development, within the framework of the Sustainable Development Goals of the UN 2030 Agenda.

Among the limitations of the present study, the initial nature of the research and the sample size can be mentioned. Regarding future prospects, it is hoped to improve the data collection design, increase the number of participants and open the work towards other issues of great environmental importance, such as biodiversity.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of ISEN.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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