Using photovoice to explore the impact on a student community after including cross-sectional content on environmental sustainability in a university subject: a case study

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Abstract

Purpose. Higher education institutions have a significant impact in preparing future generations for the creation of a sustainable society. By formulating appropriate curricula, the university can shape student personality with sustainability concerns. This study aims to present the results of a teaching approach on environmental sustainability using the photovoice methodology. A guided visit to the sewage treatment plant of A Coruña was included as a teaching activity in the "Microbiology and Parasitology" classes of the podiatry degree at University of A Coruña. The teaching objectives were to reinforce contents through observation and to introduce citizen awareness on sustainability and responsible water use in a cross-sectional manner.

Design/methodology/approach. In this case study, different steps of photovoice as a qualitative participatory action methodology were developed. A total of 43 university students willingly participated with their photographs. Qualitative data were collected from the students' photovoice visit reports and a subsequent discussion group. Thematic content analysis was performed manually.

Findings. This study explored the impact of an environmental sustainability teaching activity on the university student community. Six main categories emerged from the qualitative analysis: savings/waste of water, misuse of the water closet, disposing of used oil, solid waste/trash, reuse of clean water and reuse/reduction of the use of plastics. The cross-sectional findings on the needs of education and awareness of sustainability in the community and companies are presented.

Originality/value. The findings provide evidence of the ability of photovoice method as a pedagogical tool to promote reflection and change in the university community and to introduce sustainability cross-sectional content in green campus curricula. This photovoice experiment is simple and feasible to implement and has a very low economic cost, as long as there are qualified educators.

Keywords Environmental sustainability, University students, Photovoice, Qualitative research, Green campus

1. Introduction

The 17 Sustainable Development Goals proposed by the United Nations' publication "Transforming our World: the 2030 Agenda for Sustainable Development" are the blueprint to achieve a better and more sustainable future for all. They interconnect and address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity and peace and justice (UN, 2015). Specifically, Goal 6 (ensure access to water and sanitation for all), Goal 11 (make cities inclusive, safe, resilient and sustainable) and Goal 14 (conserve and sustainably use the oceans, seas and marine resources) are at the center of the present experiment with university students at the University of A Coruña (UDC).

Wang et al. (2013, p. 1) stated that "moving towards an ecologically sound society requires strong support from higher educational institutions" and that the transition to these societies will not be successful without the leadership of green universities that should be involved in regional sustainable development. In February 2014, the UDC signed a collaboration agreement with the Association of Environmental and Consumer Education, as a member of the international Foundation for Environmental Education (with members in 77 countries) for the implementation of the program Eco-Schools of ecological management under a "Green Campus" green flag (Foundation for Environmental Education [FEE], 2018).

Several authors proposed that by formulating appropriate curricula and course plans, the university can shape student personalities to include sustainability concerns, recognizing the importance of universities for the creation of a sustainable or green society. Therefore, nowadays, environmental instruction in higher education plays an important role in sustainability (Dagiliutè et al., 2018; Dana Boca and Saraçli, 2019; Fonseca et al., 2018; Fuertes-Camacho et al., 2019; Thürer et al., 2018).

The proposal for integrating sustainability into the curriculum was accomplished in the first year of the health sciences degree in podiatry at the UDC. The subject "Microbiology and Parasitology" is taken by the students during the second semester of the academic year from February to May. Environmental microbiology contents related to the microbial contamination of natural and artificial recreational waters, as sources of infection for the foot, are important for future podiatrists. A guided visit to the sewage treatment plant of A Coruña (EDAR Bens, A Coruña, Spain) was included as a teaching

activity of this subject. Corresponding teaching objectives were to reinforce contents through observation and to introduce students to citizen awareness on sustainability and responsible water use in a cross-sectional manner.

- Participatory photography, or photovoice, is defined as a participatory research methodology that allows subjects to narrate their experiences and produce knowledge about their surrounding context (Wang, 2003). Wang and Burris (1997) establish the following characteristics of participatory photography:
- It allows people to use photographs to show their point of view about their ideas, concerns and looks on the issues that concern them.
- Photographs become powerful objects of analysis and construction of knowledge by means of qualitative strategies.
- Participatory photography is a means of dissemination, a strategy to make proposals reach those who have the power to promote changes.

Wang (2006) highlighted that photovoice can enable young people from different backgrounds to advocate for themselves, their concerns and interests while informing policy and program design. Its goals and methods make it an emancipatory education method (Derr and Simons, 2020). Although photovoice was originally focused on public health issues (Díez et al., 2017; Evans-Agnew et al., 2017; Garcia-Leal et al., 2018; Johnston, 2016), it has been demonstrating its value as an educational strategy (Catalani and Minkler, 2010; Edwards et al., 2012; Fernandes et al., 2018; Gallagher and Stevens, 2015; Leipert and Anderson, 2012; Lichty, 2013). Some of these projects sought to strengthen the commitment of the least heard voices, others provided opportunities to discuss the strengths and weaknesses of the communities and others sought to achieve empowerment by expanding knowledge, acknowledging the plurality of knowledge, applying the theory to practical situations and by critical self-reflection (Derr and Simons, 2020). The potential of images for the confrontation of ideas and the construction of knowledge about the context should thus be considered.

This case study aims to present the results of a teaching approach on environmental sustainability using photovoice methodology. Photovoice was adopted as a pedagogical tool to place students as observers of their own community and make them reflect on

citizen awareness on sustainability and responsible water use. This was the starting point for students to evaluate – from their own voices – the impact of an innovative environmental academic activity on their citizen awareness as a member of a community, hopefully, concerned with sustainability. This case study can show if photovoice methodology could be a useful tool for discussing key community sustainability concepts in the classrooms.

Throughout this paper, the setting where this educational innovative experiment was performed and the methodology used will be described in detail. The results will be presented according to categories in the form of a narrative based on the quotations of the participating students. Finally, the results and possibilities of this methodology for the introduction of cross-sectional content related to environmental sustainability in a basic subject of university degree will be discussed.

2. Methodology

In this case study, different steps of photovoice as a qualitative participatory action methodology were developed.

2.1 Study area

This study was conducted at the university campus of Esteiro and the Faculty of Nursing and Podiatry at the UDC in Ferrol. The campus of Ferrol has been engaged in the Green Campus Program of the UDC since 2017. Its environmental committee requested the corresponding evaluation to obtain the green flag to the non-governmental organization Foundation for Environmental Education in May 2019. In October 2019, the green flag badge was obtained. In this small campus in Northwestern Spain, 1,957 undergraduates were studying during the academic year 2018–2019 (source UDC). The student population in the Faculty of Nursing and Podiatry consisted of 459 students, of which 365 were women. During the classes for “Microbiology and Parasitology” of the second semester of the first undergraduate year in podiatry, 55 students were enrolled.

2.2 Sample selection and data collection

All students enrolled in "Microbiology and Parasitology" were invited to participate in a guided visit to the sewage treatment plant of A Coruña (EDAR Bens, A Coruña, Spain). This supra-municipal company of the province of A Coruña offers a guided informative tour aimed at students and citizens of the area. Attendance at the visit and a week later delivery of the individual report contributed with 0.5 points of the final grade for the student evaluation.

Five students could not perform the activity because the visit was not recommended for asthmatic people, and therefore they were exempt from performing this activity because of medical reasons. Three enrolled students never attended classes and three grade repeaters refused to participate. The remaining students were divided into two groups to attend the visit on the 9th (23 people) and the 16th of May (21 people).

Student participation in the photovoice experiment was a proposal to be included in the report of the visit on a voluntary basis. Therefore, there would be no penalty for the student grade if it was not done. Only one student did not include a photovoice photograph in the individual report. Finally, 43 students participated in the innovative teaching experiment.

This photovoice experiment started with a first group session where the initiative was presented by the professor (CC) to all enrolled students prior the date of the visits. In this initial group meeting, the photovoice methodology and the project aims and scope were explained, as well as the report model to fill if the student decides to participate in the photovoice experiment (with a signed consent form allowing for the use of their photos for teaching and research purposes).

After visiting the sewage treatment plant, the students had two weeks to reflect on citizen awareness concerning sustainability and responsible water use. To stimulate this thinking, they had to obtain pictures with their cameras, phones or tablets, showing citizen behavior on sustainability and responsible/irresponsible water use. Three questions were provided to guide their search:

Q1. Do we make responsible use of water?

Q2. Has the knowledge about the water purification process influenced my daily life in any way?

Q3. What can I change in my daily life regarding the use of water to contribute to environmental sustainability?

The photographs should not identify people or places, should respect the anonymity of the participants and should not be offensive or degrading to any person. Finally, each student selected one photograph and filled out the report model of the visit. The report model included a page to submit the selected photograph (photovoice experiment) and the SHOWED mnemonic method (Wang and Burris, 1997; Wallerstein and Bernstein, 1988), which includes a line for the title of the photograph and five questions: What do you see here? What is really happening? How does this relate to our lives? Why does this problem or strength exist? What can we do about it? (Catalani and Minkler, 2010; Wallerstein and Bernstein, 1988).

To guarantee anonymity, the names of the participating students were codified by assigning the letter S (student) followed by a sequentially assigned number.

After a preliminary analysis of 43 individual photovoice reports, the researchers' team selected 16 reports. In this selection, the originality of the photograph was taken into account, as well as the diversity of the issues. A second group session was developed in a final meeting with all the class students. Two facilitators (CF-V, SF-B) used a presentation with the 16 chosen photographs and the SHOWED method to guide the discussion. The facilitator's objective was to make participants interact and to make sure that each participant could explain their photograph and/or participate in the debate showing their beliefs and practices. Lastly, all students were thanked for participating in the activity. The publication of the 16 selected photos on the Green Campus Ferrol Bulletin Board of the Faculty was announced and the discussion group was recorded as digital audio and transcribed.

The photographs were exhibited during the following first semester at the Faculty to make visible the photovoice experiment and to promote debate in the students' community about citizen awareness on sustainability and responsible water use.

2.3 Data analysis

Qualitative data collected from the students' photovoice visit reports and the discussion group transcription were analyzed manually and a thematic content analysis was performed (Bardin, 2016). Meaningful units were searched, codified and grouped into the main categories. A qualitative matrix was elaborated, with categories, subcategories and meaningful units. The data obtained in the photographs helped to triangulate the information obtained from the students' photovoice visit reports and the discussion group.

The emerging categories were discussed among the researchers, and shown to the students, to validate the data. The results were rigorously validated in terms of design, data collection and interpretation. The obtained data were relevant to both our project and other contexts (i.e. those of other similar studies). An attitude of self-criticism among the researchers was maintained throughout the whole process.

3. Results: presentation and discussion

A total of 43 university students of all first-year podiatry students enrolled in the course "Microbiology and Parasitology" presented 43 color photos and 43 reflections in their individual visit reports after the sewage treatment plant visit. The age group of the participants was 18–45 (mean age 22.9), and 37 of them were women. The results were obtained by qualitative analysis of the photographs, their SHOWED-based narratives and the discussion group transcription. Six main categories emerging from these photographs and their corresponding narratives were identified. These main categories were:

- savings/waste of water;
- misuse of the water closet (WC);
- disposing of used oil;
- solid waste/trash;
- reuse of clean water; and
- reuse/reduction of the use of plastics.

Several subcategories emerged in each main category. In addition, two dimensions of each subcategory were identified: criticizing behaviors and exemplifying behaviors. The matrix with those categories/subcategories and dimensions is shown in Figure 1.
A summary of the findings as well as the six main categories on the impact of environmental sustainability content learning in our experiment with university students will be presented.

3.1 Savings/waste of water

In this first category were included most of the photographs taken by the students (18 of 43). Furthermore, all pictures are focused on actions at home. They were divided into three subcategories:

3.1.1 Cleaning and cooking-related activities. First, the students captured several snapshots about washing dishes to criticize behaviors, showing for example, a person soaping the crockery while letting the water run without using it (*Irresponsible use of water* – S11 or *Unconscious waste* – S26), or using collages as an example on appropriate behaviors (*Crockery washing protocol* – S29).
In their reports, participants pointed out harmful behavior:

> The accumulation of dishes […] food waste, as well as the remains of used oils and the open tap […] are directly related to our health. (S26, female)

Students declared that this usually occurred because of the lack of awareness on the subject:

> Little awareness exists with waste of water […] we do not think about the impact this (behavior) has on our environment. (S11, female)

> We have to be aware of the misuse we do in our daily life […] be aware of how lucky we are for having water and the access we have to it […] to take care of it. (S29, female)

In their reports, students proposed simple actions such as:

> We should start raising people's awareness from an early age with images […] to teach them the consequences. (S11, female)

> Controlling the water use […] separating waste by dumping it in the garbage. (S26, female)

Participants also captured photos related to washing clothes, criticizing behaviors, showing washing machines with the door open and with half a load of clothes (*Wet reality* – S6) or with the use of long washing programs (*The time is gold* – S43). These two students highlighted some negative effects of such behaviors:

> The capacity has not been used to the maximum […] it is reflected in our water bill that increases and also in summer due to these behaviors they (authorities) have to restrict the water supply. (S6, female)

Likewise, the issue of the lack of awareness of the population was present:

> People are not aware of the amount of resources that we waste or are aware of how much we pollute the environment. (S6, female)

> People do not stop to think these things, they do not read the instructions of the washing machine. (S43, female)

And both pointed out simple solutions such as:

> Making more programs […] not showing faraway places like Antarctica but nearby places. (S6, female)

> First think twice before washing a single piece, and in case of doing it choose a short or quick wash. (S43, female)

We also found photographs related to the cooking of food, as in *Carelessness* (S30) and *Water optimization* (S35), in which pots were shown overflowing with water, inside a sink, when preparing food or washing vegetables, with the tap open instead of using a container. Lack of awareness was still present on the narratives:

> […] we do not worry about the water that we are wasting. (S30, female)

> We do not look at this type of details […] we go to the easy way of doing it. (35, female)

One student captured an image, *The drop* (S34), in which she proposed to reflect on the state of taps at home:

> Badly closed tap from which a drop of water comes out […] the simple fact of right closing the tap right would save a lot of water. (S34, female)

3.1.2 Hygiene-related activities. Daily activities such as brushing the teeth were some of the censured behaviors in photographs when they are carried out improperly (*Wasting life* – S10), in which open taps were seen at the time of brushing, or exemplary photographs (*Water saving* – S5; *Open mind, closed tap* – S42) where faucets were closed while performing the same action, even taps sealed with adhesive tape can be seen. Once again, the discourse of the lack of awareness about water waste in quotidian actions as well as sustainable proposals was present:

> Greater reserve of potable water for any purpose (agricultural, sanitary […], lower values in the water bill. (S42, male)

> Education […] a child who gets a class about that […] will come home and explain this to their closest people. (S10, male)

> To make people aware that the tap should be turned off whenever we go to brush our teeth. (S5, female)

As an example, a student captured the image, *Hygiene and water* (S17), which showed several hygiene products on a table, and jars with optimal calculated amounts of water to perform each action (such as washing fruits or pill shots). Another student showed wasting water in the hygiene of pets (*Wasting water* – S18), wherein a hose was used for washing a dog. Besides wasting water, the author criticized the use of shampoo in the wrong place, as this would be accompanied by remains of dog hairs, and end up in the pipes obstructing them. He proposed how to solve it:

> […] use a small bathroom […] we would not use a hose but we would wet the dog. (S18, male)

Finally, the activities of showering and washing hands were covered, photographing actions to censure behaviors (*Water leak* – S22; *Drop by drop we filled the glass* – S27) or to exemplify optimal behavior (*Saving water is winning life* – S40; *Soaping without water* – S32). In these cases, the students also showed their disappointment because of the low level of awareness that the current community showed about these water expenses, and they suggested overcoming actions:

> The shower tap is open and the water falling is wasted […] economic expense […] we do not reflect on it. (S27, female)

> More emphasis should be placed on educating children and the younger population. (S40, male)

> Closing the tap while we soaping our hands is a humble way to contribute to it […] with such a simple gesture we can help the environment. (S32, female)

Olsson and Gericke (2016) showed that Swedish students' sustainability consciousness dips in adolescence. It is possible that childhood students and young adult university students should be more receptive to sustainability education, as our participants suggest. A recent study with university students in the southeast region of Texas in the USA concluded that a majority of the students were not conversant with sustainability issues and were largely unaware of campus sustainability initiatives (Msengi et al., 2019). The authors stated that educational programs should incorporate sustainability into their curriculum to increase students' knowledge and consciousness regarding these issues.

3.1.3 Leisure-related activities. One student captured a photograph, 1,69x10e9 – S14, that showed a watering can floating in a pool with an approximate capacity of 70,000 liters. Its narrative showed how, in our leisure time, we waste water without reflecting on our actions:

> […] (the pool) is the approximate amount of water consumed by a family formed by 4 members, in only 3-4 months […] reflect the consumption of unnecessary water that we carry out in our leisure (pool) and in our housework (watering plants) […] (S14, female)

And proposed solutions such as:

> Taking advantage of rainwater […] awareness campaigns […] raising taxes. (S14, female)

In the group discussion, participants agreed that individual water-saving measures are mainly motivated by economic savings and not by environmental reasons. They also pointed out that the lack of awareness in our setting, where rainfall is abundant, may be related to the difficulty in thinking that water is a scarce resource in other parts of the planet:

> First you notice it in your pocket and then you start to think about what is around […] Things should not be like that but […] (S2, female).

> I think the problem is, specially here in the North, in Galicia, we think we have loads of water […] here we think that water is infinite, unlimited and that we will have all that we will need forever. (S14, female)

Figure 2 shows the qualitative data matrix of the category savings/waste of water, serving as an analysis methodology example.

3.2 Misuse of the WC

The second most photographed theme (ten participants) was related to the misuse of the toilet. This category consists of three subcategories that will be detailed.

3.2.1 Remains of hairs. Participants took photographs representing actions that should not be performed, such as throwing hairs by the WC (*The profane of human being* – S31; *Tangle* – S41; *Hairs on the toilet?* – S7). Students learned the consequences of this act during the sewage plant visit:

> Consequences such as the time the hairs take to decompose, clogging in the drain pump. (S31, female)

> We harm the purification plant that is a public company and we all pay for it, and we also harm the environment in which we all live. (S41, female)

The students showed a simple solution:

> Throw the hairs in the trash that should be in our bathroom. (S7, female)

3.2.2 Garbage in the toilet. Participants presented impressive images such as *Earth, sea or trash, which do you choose*? – S33, *Less to water* – S39 or *Fight the monster* – S15, to criticize another day-by-day reality of our community. The use of the WC as a garbage dump was a consequence of ignorance and convenience. Some solutions were shown:

> Ads on television […] even on social networks […] putting a bin in the bathroom. (S39, female)

> Putting a wastebasket in the toilets […] creating awareness campaigns, but above all information because there are many people who do not know that this (behavior) happens. (S20, female)

Relative to the use of media, Keinonen et al. (2014) found that, for students in Finland, Lithuania and Sweden, the most important source of environmental knowledge was found to be the internet, followed by newspapers, television, school and education. In their own lives, students discussed environmental issues every day and, to some extent, in social media, discussion forums and blogs. Hamid et al. (2017) summarized and commented on the role of social media to garner interest of students and staff on environmental sustainability issues. They proposed that propagating environmental sustainability awareness in higher education would be more effective with the use of

social media. Sustainability practices conducted at the university level, such as recycling, reduction of electricity and water consumptions and paper reduction in the classroom should be used to engage students on environmental matters.

3.2.3 Types of disposable paper in the toilet. Trying to exemplify this situation, two students photographed several drinking glasses in which they had introduced different types of papers. They wanted to show that only the toilet paper can be discarded in the WC and the consequences of not doing it correctly:

> The degradation of different materials that we usually eliminate by the toilet can be observed […] it is the only paper that can be deposited in the toilet […] the other papers are not prepared to deteriorate so easily […] clogs in sewers and sewage treatment plants […] we are increasing the expenses in water purification, contaminating the sewers. (S12, female) [Figure 3(a)

During the group session, the students stressed that only after visiting the sewage plant did they learned everything that they did not yet know about the real environmental inconvenience of the behaviors reported in their photographs:

> During the visit (to the sewage treatment plant) I learned that. I did not know that when you threw a tissue in the toilet it took so long to degrade. (S14, female)

3.3 Disposing of used oil

Regarding the means of disposing of used oil, two topics were discussed. First, topic such as actions carried out at home. Second, topics such as actions developed at outside home.

At home, participants censured daily situations through photographs such as *Mortal habit* – S23, in which pouring oil from a pan directly to the sink was shown [*Used oil in the sink* – S19, Figure 3(b)]. Students explained their message intention and proposed the correct behavior in their narratives:

> Instead of recycling it in a bottle or container […] besides not being aware of the true repercussions of this habit, people prefer to get rid of the oil in this case in an inadequate and comfortable manner. (S23, female)

> By increasing oil collection points and creating more campaigns and information teams. (S23, female)

Positive exemplifying images were also reported, such as Oil seas – S1, in which a collage composed of two photographs was performed:

> […] frying pan filled with oil after being used in a sink, for washing and the second (photo) a filled bottle with used oil. (S1, male)

At the community scenarios, a photograph, *Water free of oils* – S4, showed a person recycling the used cooking oil in a specialized container. The narrative stated:

> Contaminated water requires a long and expensive process to restore their properties […] ignorance of the existence of this type of containers […] accumulate in a plastic bottle all the cooking oil that is no longer valid for use. (S4, female)

In the discussion with the students, the discourse on recent learning achieved during the visit to the treatment plant was repeated. The need to involve companies in the adequate elimination of industrial oil was agreed between them:

> I believe that you should not educate only on a personal level, companies also pour oils and other products that affect the environment. Then, somehow we should also raise awareness of sustainability on companies too. (S33, female)

3.4 Solid waste/trash

Outside the university, the students captured images in which, with positive or negative messages (criticizing behaviors), showed corners of streets full of garbage on the ground [*Garbage between containers* – S3; *Multifactorial contamination* – S8, Figure 3(c)], inside sewers (*Killer butts* – S13) or rivers full of solid waste (*Cleaning along the*

river – S24). The consequences of these incorrect actions are diverse, as participants pointed out:

> These plastics can become microplastics that can arrive to the sea becoming food for the fish […] and these fish will later become our later food. (S3, female)

> There are studies that show that they (cigarette butts) take 10 years to decompose […] plenty of cellulose acetate that is derived from petroleum, it also contains all the contaminants of a cigarette that we do not want to pass to the body. (S13, female)

Students' narratives in this category also denounce the lack of knowledge and awareness of the bad effects of these habits. Among the students' proposals, it is worth noting the need to increase the number of sustainable disposal facilities, to educate fellow citizens directly when they carry out inappropriate behavior, and even to criticize this type of behaviors on social networks, especially with young citizens:

> Very little awareness on the part of people […] taking care of the areas that we all use, educating the population and, above all, raising awareness of the risks. (S8, female)

> It is better to increase the number of sustainable disposal facilities. Increase […] because, for example, in many towns there are still no containers to recycle, which has to change a lot […]. (S14, female)

> Well I would mention it on Facebook. (S17, female)

In the group discussion, this category was related to garbage problems that originate in young or university communities with university parties and other youth parties. Students reflected on the influence of alcohol on reprehensible behaviors, and on the need for organizers to be involved in the reduction and collection of garbage. They argued that organizers (municipalities sometimes) are dedicated to alleviating the problem but not to raise awareness among young people. Finally, they made proposals to solve these problems:

> […] at university parties there have been many problems with garbage that has been left there […]. (S14, female)

> […] i leave it here because tomorrow the council is going to put someone who is going to go and tidy it up. (S30, female)

> There are parties that when you arrive, instead of giving yourself several glasses […] it costs you one euro, and then when you leave you get it back. (S43, male)

> In my area, when the parties […] the organization, the next day, people gather to go tidy things up. (S2, female)

The results of this category coincide with Ahmad et al. (2016) who asserted that, in students from higher education institutions in Pakistan, the degree of information and understanding of environmental-related aspects notably affected attitude, concern for one's community and knowledge regarding recycling activities.

3.5 Reuse of clean water

The students proposed several ways to reuse the water at home. Reusing water from the dehumidifier [*Reuse and save water* – S28, Figure 3(d)], taking advantage of the water that comes out in the shower before reaching the appropriate temperature (*An appropriate use brings life* – S36) or taking advantage of rainwater, collecting it with containers (The crops – S37).

> The water collected from the dehumidifier was used to irrigate the plants in my garden […] a way to save water instead of throwing it out […] showing an alternative of using water in good conditions that we usually throw away. (S28, female)

> If during every shower, we took advantage of the water that comes out until it gets hot, we could make a great use of it for, for example, watering, washing the car. (S36, female)

> […] saving water and taking advantage of rain to benefit our crops […] minimal effort is saving water, using it in a responsible manner. (S37, female)

Therefore, students agreed that economic motivation prevails over sustainability awareness:

> Honestly, I believe that is an economic issue. […] My parents helped me not to do it, you know? But, even so, it was for economic reasons, it was not for the environment nor […]. (S28, female)

Increasing urban water demand has led to the exploration of the potential of rainwater use and water recycling to promote sustainable management of water resources. This concern led to implement a rainwater harvesting system at the Macdonald Campus of McGill University in Quebec, Canada (Islam et al., 2013). After two years of operation, it was found that the amount of rainwater collected did not only meet the peak irrigation demands of the greenhouses, but there was also enough water for the irrigation of the students' gardens. Velasquez and Yanful (2015) revealed that the majority of the university community at Western University in Canada thought that reusing water to provide an alternate source of water in southwestern Ontario is a good idea, but there were concerns about the presence of chemicals such as pharmaceuticals from reclaimed water and long-term effects on human health from exposure to these contaminants. These concerns could explain the proposal of Spanish students for the exclusive reuse of clean water.

3.6 Reuse/reduction of the use of plastics

Another sustainable action portrayed by the students in their reports was the reuse of plastic bottles at home. They criticized that:

> […] for many people it is more convenient to buy a plastic bottle in any vending machine and then throw it away than having to carry a glass bottle all the time. (S25, female) [Plastic bottles in two days – S25, Figure 3(e)

Again, the lack of awareness of the subject as well as the convenience and routine driving many of our daily behavior gave rise to negative effects on the environment. The educational need on different areas to modify incorrect habits was present in the discourses. The students proposed once again to involve companies in sustainability matters. This time, by reducing the use of plastics:

> They charge the bag at 5 cents, but then everything you take is bagged. You buy a cauliflower and they have to put it in a bag. (S33, female)

Plastic waste is one of the most critical environmental issues. De Gisi et al. (2017) performed a pilot project action in a small Mediterranean island of Southern Italy. They installed a water kiosk to reduce plastic waste production. The water kiosk was perceived positively if it only serves residents. Participants were rather skeptical on the installation of the water kiosk as a solution to satisfy the water demand during the touristic periods. Uehara and Ynacay-Nye (2018) investigated how installing water bottle refill stations can deter Japanese university students from using disposable plastic bottles. According to the study, 58.82% of students stated that they would be willing to use the system and to support its cost. Students' willingness to pay to install and use the system increased with the introduction of more information about pro-environmental behaviors, indicating the importance of information campaigning and learning how to encourage pro-environmental behavior.

In photograph, Life – S21, one of our students reflected on the life of fish and plants, evoking the notion that water is life and considering the importance of keeping the planet's water bodies healthy for life:

> Showing how the life of fish and plants in the water develop […] understanding how water is of vital importance in our lives […] helping to understand how many ecosystems can develop thanks to water […] being responsible and making us aware of the importance of water for life. (S21, female)

3.7 Needs of education and awareness of sustainability in the community and companies

Under this section, we describe a set of results that were obtained in a cross-sectional manner across the six categories that emerged from data analysis. These results correspond mainly to the reflections that took place during the group discussion session in which all the students participated.

Most students reported that they had not received training in sustainability issues until they attended university. They considered that sustainability training should begin in childhood at home, later as cross-sectional content in the school and finally be reinforced in the university when many of them start their lives apart from their family. They also stressed the importance of social networks to raise awareness in society:

> Since childhood and at home. (S43, female)

> I think it's important [education at home] but there should be subjects teaching how to do this […] from the beginning, that is, 3 years old. (S33, female)

> It is when we live alone, the majority, and then it is good to remember it. But, it is knowledge that we already had acquired. (S33, female)

The students highlighted the important responsibility that companies have in protecting the environment. They affirmed that they came to understand the companies' environmental liability during the visit. They agreed that it would be important to establish legal means to punish companies that fail to comply with environmental regulations, and reward companies that are committed.

It was revealed that the environmental policies of companies should be better known, and that if prices were not overcharged, students would prefer to buy products from environmentally committed companies.

> I believe that by raising everyone's awareness on a personal level, we also raise awareness of people who work in companies. And by regulating companies more strictly. (S14, female)

> It depends on the limits, if the price is a little higher […] I, for example, would invest on it. I would not mind spending a little more knowing that I help […]. (S1, male)

> […] if you go to a bar, many uses recycled napkins or have […] I do not know, for example, the menu is made of recyclable paper or […] Well, it seems good, truly […] That helps the environment. (S1, male)

Environmental concern and habits of university students has been explored in the past few decades in several countries. Results from quantitative studies often vary. The main drivers explaining the environmental practices of university students were gender, field of study, perceived consumer effectiveness and socio-economic status (Chuvieco et al., 2018). Kukkonen et al. (2018) stated that among university students, the enjoyment of nature is positively related to the intent to support pro-environmental activity and to environmental knowledge. These authors suggested that the growing global concern about environmental problems should also provide stronger support to extend and improve environmental education. Changing current patterns of university education is also critical to create in-depth alternative views toward environmental problems that link global factors and responsibilities to personal values and commitments (Chuvieco et al., 2018; Dana Boca and Saraçli, 2019; Thondhlana and Hlatshwayo, 2018).

This study aimed to introduce a participatory action qualitative technique to involve university students in promoting environmental sustainability for behavioral changes and concerns in their community. Dagiliutè et al. (2018) found that only campus sustainability and environmental information significantly determined students' involvement in sustainability, and that official declarations and commitments should be performed in specific campus activities.

Habermas' (1971, 1981, 1987) work in the construction of knowledge, intersubjectivity and communicative action can be used to examine what occurs in the process of raising awareness of environmental sustainability. According to Habermas (1971, 1981, 1987), knowledge is socially constructed and understanding involves dialogue with others, reflexivity and taking a position. Our results offer the awareness processes of these students and highlight the experience of learning and understanding during their interaction. Photovoice images are often rich in metaphor. A metaphor can capture complexity in a simple manner and facilitate the expression of complex experiences or ideas, compared to conventional techniques (Rania et al., 2015). Furthermore, the discussion of those photographs is integral to the photovoice methodology. These discussions can provide richer and more nuanced data (Darbyshire et al., 2005; Guell and Ogilvie, 2015).

This photovoice experiment allowed students to express beliefs, values and perceptions, and to develop empathy regarding citizen awareness on sustainability and responsible water use. These findings are in line with several studies, in which photography is a good tool to stimulate these skills (Aranda et al., 2015; Brand et al., 2016). Moreover, this experiment allowed us to promote reflection and change. Different authors suggested that the photovoice medium can be used creatively to provide students with an enjoyable activity that will lead to reflection and critical thinking about their practices in nursing, psychology or health sciences degrees (Edwards et al., 2012; Fernandes et al., 2018; Gallagher and Stevens, 2015; Leipert and Anderson, 2012; Lichty, 2013). The academic experience presented in this case study allowed students to use cameras/mobile (common daily appliances), to reflect about individual and community practices related to sustainability, participate in discussion groups and show the photos at university to draw attention, to promote the reflection and change in all the community. This is a novel and attractive tool, and its simplicity and low cost can encourage educators to introduce it in academic fields (Andina, 2020).

Recently, Fuertes-Camacho et al. (2019) described that the students' sustainability competencies improved after integrating sustainability into education degree curriculum through the project method. Our results show that students of health sciences positively responded to sustainability cross-sectional content in a basic subject of their curriculum via photovoice participatory action method.

Our study results coincide with Lucio et al. (2018); they showed how university students are conscious of the need to reduce waste of water. These authors highlighted the importance of family values as the main determinant of pro-environmental behaviors. In our study, students proposed that environmental sustainability concerning use of water (among other topics) should start to be worked at home.

4. Conclusions

This case study demonstrates the feasibility of introducing cross-sectional content concerning sustainability in the curriculum of students of a sanitary degree such as podiatry. By using the photovoice methodology, the participants were placed as observers of their own community to achieve public awareness of sustainability and the

responsible use of water. All of this with the ultimate goal of becoming agents of change. The UDC is a higher education institution committed to environmental awareness and sustainability. The authors of this study are educators committed to their role in creating a sustainable and green society. In the context of a basic degree training subject, this article describes the adaptation and incorporation of photovoice as a medium to furnish students with an enhanced experience on environmental awareness and habits. Our results provide evidence of the ability of photovoice to promote reflection and change in the university community and to turn them into agents of change in the society to which they belong. It could be considered very interesting as our students are future health professionals who will certainly assume their role as reference figures in their respective communities.

On agreement with Leal Filho et al. (2018), it can be concluded that transformative approaches to enhance sustainability in the curricula are feasible and desirable. They proposed that universities should pay more attention about the need to work toward integrating practice and theory, and student engagement through synergetic action and ethical discussions.

An example of how sustainable development is being incorporated as a cross-sectional part of a basic health science degree subject has been shown – a university-level approach for embedding sustainability, as the one used on the Ferrol-UDC Green Campus Program. This initiative was possible through academic community engagement and general campus actions as tools for transformation in learning and education for sustainability. Reflections of the academic community on their own values and support of the universities should be crucial for developing the transformative potential of students as future decision-maker agents of a sustainable world.

It can be stated that these findings provide positive insight for suggesting photovoice method implementation as a pedagogical tool for discussing key community sustainability concepts in the classrooms, and for introducing sustainability cross-sectional content on green campus curricula. This photovoice experiment offered insight that is not accessible through other qualitative methods. It is simple and feasible to implement and has a very low economic cost, as long as there are qualified educators. Both characteristics have led the Environment Office of the UDC to request

collaboration from the authors to implement this tool in monitoring and evaluating the environmental awareness activities it organizes for the university community.

The use of the academic experiment described is proposed for including cross-sectional content on sustainability in other basic subjects of different green university degrees, in the health field or even in other fields that may be seem to be more distant in principle. The effective application of the method in the surrounding world makes it possible.

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Acknowledgements

The authors acknowledge the first year students in podiatry degree (UDC) for their commitment and enthusiasm in participating in the experience described in this study.

Supported by the Xunta de Galicia (Competitive Reference Groups ED431C-2018/38), Spain.

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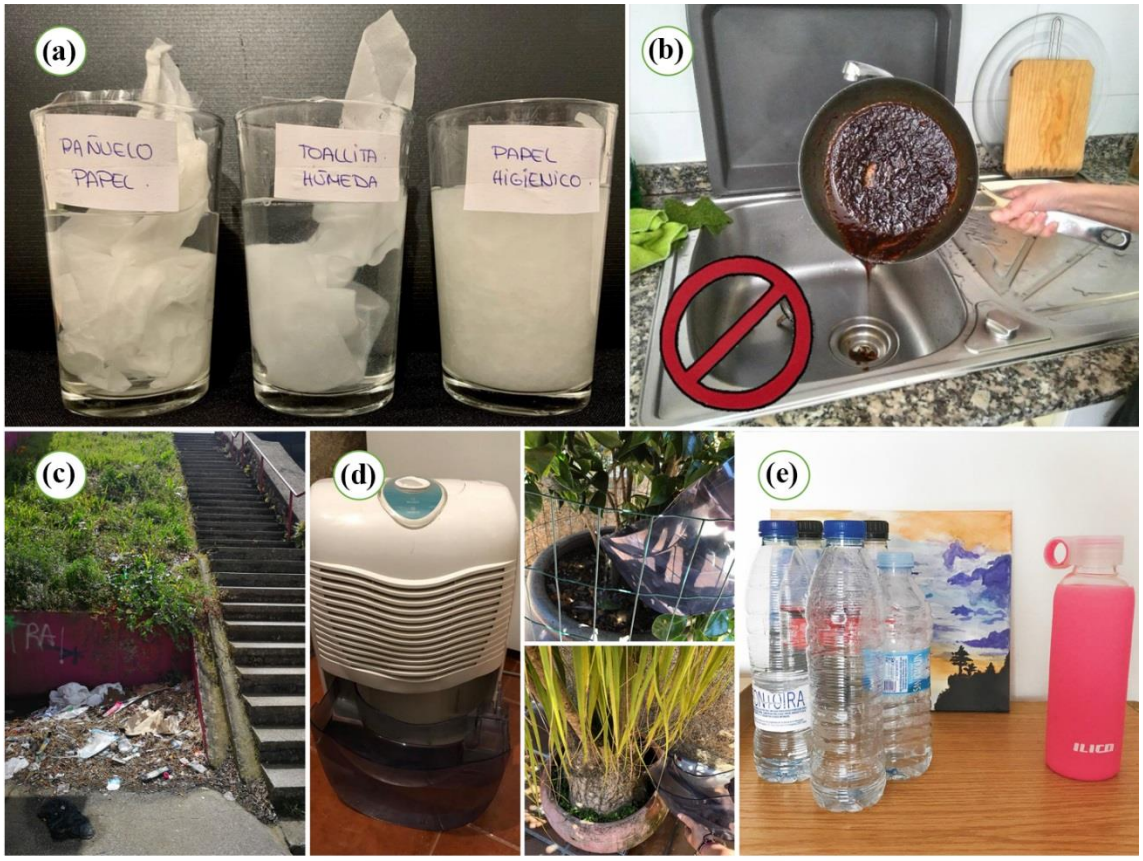
Main categories	Subcategories	Dimensions
Savings / Waste of water	*Cleaning and cooking related activities*	Criticizing behaviors
		Exemplifying behaviors
	Hygiene related activities	Criticizing behaviors
		Exemplifying behaviors
	Leisure-related activities	Criticizing behaviors
		Exemplifying behaviors
Misuse of the WC	*Remains of hairs*	Criticizing behaviors
		Exemplifying behaviors
	Garbage in the toilet	Criticizing behaviors
		Exemplifying behaviors
	Types of disposable paper in the toilet	Criticizing behaviors
		Exemplifying behaviors
Disposing of used oil	*At home*	Criticizing behaviors
		Exemplifying behaviors
	Outside scenarios	Criticizing behaviors
		Exemplifying behaviors
Solid waste / Trash	*Outside scenarios*	Criticizing behaviors
		Exemplifying behaviors
Reuse of clean water	*At home*	Criticizing behaviors
		Exemplifying behaviors
Reuse / Reduction of the use of plastics	*At home*	Criticizing behaviors
		Exemplifying behaviors

Figure 1. The matrix summarizing categories/subcategories and dimensions emerged from the qualitative data of the study

Main category	Subcategories		Dimensions	Photographs	Meaningful units
Savings / Waste of water	Cleaning and cooking related activities	Cleaning related activities	Criticizing behaviors	 *Irresponsible use of water* (S11 , female)	Lack of awareness: Little awareness exists with waste of water ... we do not think about the impact this (behavoir) has on our environment. Simple actions: We should start to raise people's awareness from an early age with images ... to teach them the consequences that can occur due to misuse.
				 *Unconscious waste* (S26, female)	Harmful behavior: The accumulation of dishes ... food waste, as well as the remains of used oils and the open tap ... is the reality of many families ... it has serious and unconscious repercussions ... it is directly related to our health. Simple actions: Controlling the water use ... separating waste by dumping it in the garbage.
				 *Wet Reality* (S6, female)	Harmful behavior: The capacity has not been used to the maximum ... wasting water and money ... waste of resources ... it is reflected in our water bill that increases and also in summer due to these behaviors they (authorities) have to restrict the water supply. Lack of awareness: People are not aware of the amount of resources that we waste or are aware of how much we pollute the environment. Simple actions: Making more programs to raise awareness, but not showing faraway places like Antarctica but nearby places.
				 *The time is gold* (S43, female)	Lack of awareness: People do not stop to think these things, they do not read the instructions of the washing machine. Simple actions: First think twice before washing a single clothe, and in case of doing it put a short or quick wash.
				 *The drop* (S34, female)	Simple actions: Badly closed tap from which a drop of water comes out ... waste of water ... carelessness ... little importance we give ... the simple fact of right closing the tap would save a lot of water.
			Exemplifying behaviors	 Crockery washing protocol (S29, female)	Lack of awareness: Responsible use ... we are not aware that in many countries people can't access this good ... we have to be aware of the misuse we do in our daily life ... be aware of how lucky we are for having water and the access we have to it ... to take care of it.
		Cooking activities	Exemplifying behaviors	 *Carelessness* (S30, female)	Lack of awareness: ... we do not worry about the water that we are wasting.
				 *Water optimization* (S35, female)	Lack of awareness: We do not look at this type of details ... we go to the easy way of doing.
	Hygiene related activities	Brushing teeth	Criticizing behaviors	 *Wasting life (S10, male)*	Simple actions: Education and the awareness on water worth for living beings ... a child who receives a class ... will come home and explain to their closest people.
			Exemplifying behaviors	 *Water saving* (S5, female)	Simple actions: To make people aware that the tap should be turned off whenever we go to brush our teeth.
				 *Open mind, closed tap* (S42, male)	Harmful behavior: Greater reserve of potable water for any purpose (agricultural, sanitary ...), lower price in the water bill.
		Hygiene products	Exemplifying behaviors	 *Hygiene and water (S17, female)*	Lack of awareness: It is a visual way of understanding that you do not have to spend more than you really need because it is to spend in vain.
		Hygiene of pets	Criticizing behaviors	 *Wasting water* (S18, male)	Simple actions: ...use a small bathroom ... the hairs ... could be collected ... we would not use a hose but we would wet the dog.
		Showering and washing hands	Criticizing behaviors	 *Water leak (S22, female)*	Simple actions: One solution is to place the bucket of the mop under the shower and use this water to mop the floor, for example.
				 *Drop by drop...* (S27, female)	Lack of awareness: The shower tap is open and the water falling is wasted ... waiting for the water to heat ... economic expense ... habits that we acquire throughout our lives and we do not reflect on them.
			Exemplifying behaviors	 *Saving water is winning life* (S40, male)	Simple actions: More emphasis should be placed on educating children and the younger population about responsible water use.
				 *Soaping without water* (S32, female)	Simple actions: Closing the tap while we soaping is a humble way to contribute to it ... with such a simple gesture we can help the environment.
	Leisure-related activities	Swimming	Exemplifying behaviors	 *1,69X10e9* (S14, female)	Harmful behavior: ... (the pool) is the approximate amount of water consumed by a family formed by 4 members, in only 3-4 months... reflect the consumption of unnecessary water that we carry out in our leisure (pool) and in our housework (watering plants). Lack of awareness: we continue consuming without thinking until we will be in trouble. Simple actions: Taking advantage of rainwater ... awareness campaigns ... raising taxes.

Figure 2. Qualitative data matrix corresponding to the main category savings/waste of water



Notes: (a) Only toilet paper in the toilet – S12; (b) used oil in the sink – S19; (c) multifactorial contamination – S8; (d) reuse and save water – S28; (e) plastic bottles in two days – S25

Figure 3. Representative students' photos from the different categories