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Infusing Environmental Studies in the Undergraduate Curriculum of a Home Science Program: A Pedagogical Intervention

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Abstract

Environmental Studies (ES) is an important theme that features all through school education and also finds a place at the undergraduate level. However, the implementation of the ES curriculum at the undergraduate level is largely done in a theoretical and pedantic manner. Moreover, the theme may also lack relevance for students who are pursuing degrees that may not seemingly or directly be related to the environment. In order to address these issues, an intervention was designed collaboratively between the institutional stakeholders; and implemented in a college of home science. This article reports the various aspects of the intervention undertaken as well as the insights gained from students' feedback. Recommendations to enhance the intervention are presented at the end.
***Keywords**: Environment Studies, Pedagogy, Undergraduate curriculum, Project-based Learning, Environment Education*

Introduction

The importance of having environment education (EE) in mainstream education gained importance after the Tbilisi Declaration (1977). It was during this time, broad goals and principles of EE were laid out and there was an emphasis to direct the young minds towards achieving a better understanding of the natural world around them. EE was based on the *"assertion that both the natural and human built environments, locally and globally, are interdependent and include interactions between biological, economic, social, and cultural forces"* (pg 3; UNESCO 1980 cited in Locke, Russo & Montoya, 2013). It therefore also follows that in addition to encouraging values and sensitivity towards the environment, there needs to also be emphasis on life skills of problem solving, empathizing, cooperation, collaboration and gaining holistic perspectives. After the 1992 Earth Summit in Rio de Janeiro, initiatives and policies around EE (also known as Education for Sustainable Development) picked up pace throughout the world.

India has historically been a propagator of social and cultural values which are intertwined with that of preservation of the environment around us (Almeida & Mackenzie, 2011). In the pre-independence era, there were efforts to "environmentalise" the teaching – learning process in schools. For example, Mahatma Gandhi's Basic Education Movement (*Nai Taleem*) which stressed on the need to contextualise school

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education to local environmental needs. Subsequent to the 1992 Earth Summit (UNDCC, n.d), the national policies of education also emphasized environmental education at various levels. Environmental studies (ES) started to feature across the various (central and state) education boards in India, either as an independent subject or as an infused subject at the school level (NCF 2005; Sonowal, 2009).

Anxious that the study of the environment was not receiving adequate attention in academic programs across the country, the Supreme Court of India directed the University Grants Commission (UGC) to introduce a basic course on Environmental Studies in all undergraduate branches that comes under the purview of the UGC. Accordingly, a six-month compulsory core module course in Environmental Studies was prepared by an expert committee and implemented in colleges across the country (UGC, n.d).

The current study was conducted in one such undergraduate college Dr BMN College of Home Science, Mumbai. The college is autonomous under the SNDT Women's University and caters to female students mainly between the age group of 18 to 23 years. After completing 2 semesters of introductory and foundation courses, the specializations offered under the Home Science Faculty are Food Science and Nutrition, Nutrition and Dietetics, Human Development, Textile Science and Apparel Design and Resource Management. The institution is multi-faculty and also offers an undergraduate program in Computer Applications (BCA). A course in Environmental Studies (ES) is mandatory in the first year of both programs. It must be noted that students in the Home Science program chose their specializations only in the 4th semester. They are however offered introductory and foundation courses in semesters 1-3 which prepares them for the curriculum that follows as part of their specializations.

The ES faculty and then in-charge of the Environment Sensitization Committee (second author) for the academic year 2021-22 at this juncture raised the concern that while the mandatory subject of ES did introduce environmental topics to students, it did so at a pedantic and theoretical manner. There was a need for intervention strategies which would engage students at a much deeper level, and which would enable them to link their major subjects in the subsequent years with the pressing environmental concerns, thereby making it more contextual and relevant for students. Additionally, it was felt that there is an overlap and repetition of content taught at school level which impacted the general interest level of students. Events related to the environment organised by the Department, as well as the college's Environment Sensitization Committee were one-off events which included lectures, workshops or talks with experts from the domain. While these events piqued students' curiosity in the subject, it did not necessarily lead to sustained interest. These initial concerns raised by the faculty member along with all the other factors mentioned above seeded the initial motivation to pursue an approach involving a more sustained intervention (McNiff, 2013; Altrichter, Posch, & Somekh, 2007).

Since there was consensus to have more sustained efforts to inculcate an ethos towards environmental consciousness wherein students would imbibe and practice environment friendly actions on campus and their neighbourhoods, a slightly longer intervention was initially strategised. The driving factors that underlined the intervention were; brainstorming the ways in which environmental studies could be contextualized for UG students of the two programs offered by the institution and developing project ideas that touch upon students' major subject as well as the environment.

To address this, the college reached out to the Homi Bhabha Centre for Science Education (HBCSE) in Mumbai, a National Centre of the Tata Institute of Fundamental Research (TIFR), whose broad goals are to promote equity and excellence in science and mathematics education, from school to undergraduate college level as well as to promote scientific literacy in the country. The academic collaboration was focussed on designing innovative approaches which would enhance the receptiveness of students, as well as the motivation of teachers involved in imparting the ES curriculum, in a manner which is related to real and field learning. The focus was also to bridge the gap between the intended objectives of the ES syllabus and the actual practicalities of implementing the same.

Theoretical framework, study context and methodology

The current study aligns itself with the social design-based research (DBR) framework which brings together DBR alongside collaboration between the institutional stakeholders so as to work towards co-constructing the intervention (Gutierrez, Jurow & Vakil, 2020; Design Based Research Collective, 2003). Over a period of one semester, there were multiple interactions between both stakeholders which led to the intervention. Additionally, it was important to review the entire syllabi of the respective domains within the Home Science curriculum. Having done that, a first set of possible project ideas were proposed to the teachers. Teachers who interacted closely with students and who had years of experience gave their feedback on these ideas which were then reworked on. Several project ideas were also proposed by the concerned faculty members themselves. At each stage, teachers too interacted with their students in order to get feedback on the project ideas in terms of difficulty, feasibility and timelines.

Typically, the college assigns projects to first year students as a way to initiate students into research. Students would undertake independent proto research projects and submit a project report at the end of the semester. The intervention was therefore planned using these project modules for which they are evaluated. Instead of being completely open ended and from various domains, the project ideas were generated in collaboration with faculty from the specializations which could be offered to students in the 4th semester onwards therefore initiating the possibility of an interdisciplinary approach between environmental related projects and the focus areas of the respective specializations. For example, a project on "eco-dyes" touched upon how one can extract natural eco-friendly colours for textile dyeing. Similarly, other project ideas were shared with students, which is listed in table 1. Expectations from students were that they had to present a project report at the end which included rationale and literature review to the topic chosen, make a prototype (if relevant), present a preliminary analysis of the data collected (if any), describe the process and outcome of their product, discuss implications, include photographs or videos (as evidence) if possible. The project ideas were shared with first year students (around 105 FY BSc and 29 FY ND and 130 FY BCA students) and students were encouraged to work in groups.

Observations and preliminary analysis

This section discusses the various projects undertaken by students and their reflections as reported in their project reports. A preliminary analysis on 61 project reports was undertaken which were submitted by either individual students or groups, with overlap of student participation. It is important to note that this intervention was carried out during the COVID-19 pandemic when colleges were largely working online and physical interactions between faculty and students were almost nil. Teachers also reported that student participation in classes and other activities had dropped heavily over the semester for several reasons, amounting from access to technology to screen overtime. This also explains why only a small section of students (despite the large class size) actually completed their projects even though it carried credits and they were evaluated for it. The projects discussed below are categorized on the basis of the specialisation subjects that the B.Sc students can opt for in the second year of the program.

Human Development

Twelve students chose to do Project 1 (Refer Table 1). Their studies involved interviewing young children and their experiences during the pandemic. Children's responses varied from missing their grandparents, playing

Subject	Project Title	Description of Project	Knowledge/ Skills addressed
Human Development (Project 1)	Case study: Understanding effects of lack of outdoor activities on emotions of a child during the pandemic.	In this project, students are expected to conduct an in-depth interview of one school going child and understand what emotional trajectory he/she has gone through over the last 2 years, in the context of - not being able to play outside - visit playgrounds - travel to places/ going to native place - access to nature	Core subject related: Research methodology, Child psychology/ Socioemotional development, Interviewing skills, Ethics of research Environment related: Physical and mental wellbeing due to nature and being outdoors Other skills: To do this study, consent form from a parent is compulsory. Child's identity should not be revealed. Use a pseudonym in the project report.
Human Development (Project 2)	Design a simple game on the theme of environment/ environment protection/ wildlife.	In this project, students are expected to design an original game which can be played by a single child or in a group. The time taken to play the game can range from 5 to 30 minutes.	Core subject related: Strategies for Early Years (ages 3-6) & Foundational Years (ages 6-8), Play: Meaning, Importance, developmental domain(s) enhanced & competencies developed through play, types and stages of play, materials & techniques, etc., creative art and craft, foundational literacy, child psychology etc. Environment related: Building awareness around a specific environmental topic Other skills: Design thinking, ideation
Resource Management (Project 1)	Estimating Green Cover in your area.	In this project, students are expected to locate their residences on Google Map and learn how to calculate area from google maps. They need to mark a square area around their home (roughly 5,00,00 sq.m) and analyze how much green cover (tree cover only) is there in that area using the satellite imagery (mode) of google maps. The project also involves calculating the area of this green cover and finally representing the green cover as a percentage of total area studied.	Core subject related: Map reading skills and local geography, reading satellite imagery Environment related: Awareness on how much greenery is there in your area Other skills: There are also other scientific and mathematical skills associated with this activity. For eg, estimation skills, basic mathematics, observation, analysis, use of digital tools.
Resource Management (Project 2)	Conceptualize an Eco Resort in a place of your choice (in India) with the USP being that is sustainable and environment friendly. Also, design a pamphlet for this new	In this project, students have to ensure that all the factors involved in the Eco Resort they conceptualize are sustainable and environment friendly. Points to keep in mind: Location of the Resort, Food served there, Staff who works there, Facilities in the resort, Cuisine, menus, Waste Management, Landscaping, Recreational options available for guests, Transportation, Inventory for the resort, choice of service equipment, design and décor,	Core subject related: Travel management, food and beverage services, professional communication skills for hospitality industry Environment related: Understanding of ecotourism and sustainable tourism Other skills: There are also other 21st century skills associated with this activity like communication skills, product design, graphic designs, reporting and documentation

	Eco Resort.	space, lighting and ventilation, furniture, Water sources, Energy (electricity) source, etc. Students can use any format/ software to design the pamphlet.	
Textile and Apparel Design (Project 1)	Eco dyeing , Eco printing on textiles/ Exploring potential natural dyes.	In this project, students are expected to work with any natural material and extract the dye from it. They are then required to use it on fabrics and check their efficacy.	Core subject related: Skills directly associated with textile and apparel design like dye extraction and experimenting on fabrics. Environment related: Being aware of the eco-friendly alternatives in their area.
Textile Science and Apparel Design (Project 2)	Best out of waste - from leftover fabrics (old clothes etc.)	In this project, students have to create innovative products from waste fabrics.	Core subject related: Skills directly associated with textile and apparel design textile product designing. Environment related: Being aware of the eco-friendly alternatives in their area.
Food Science and Nutrition (Project 1)	Microgreens	Microgreens are essentially young plants which are consumed for their nutritional value. In this project, students have to grow a microgreen plant of their own and document the process.	Core subject related: Awareness around healthy eating, nutritional values of microgreens, sustainability issues surrounding microgreens, Hands-on experience of growing microgreens, Reporting and documentation skills Environment related: Alternative sustainable options for crop growing
Food Science and Nutrition (Project 2)	Develop or compile innovative recipes from ingredients which one might typically classify as 'food waste' (like vegetable or fruit peels etc.)	In this project, students are expected to experiment and practically try out some innovative recipes usingingredients which one might typically classify as 'food waste'. Students are also expected to think about nutritional value, energy, calories etc., while developing the recipes; and also document the process.	Core subject related: Innovating healthy and environment friendly recipes. Environment related: Awareness around food waste, and waste management, issues related to farm to plate, sustainable agriculture, organic food waste
Computer Application (Project 1)	Accounting / Managing Finances for an Eco-friendly lifestyle.	In this project, students have to predict their financial outflow if they change to buying only eco-friendly products. For this, they need to list out the monthly supply of items they buy, its quantity and rates. Replace that item with an eco-friendly product they find in the market and then calculate the expenditure for the entire month. Lastly, analyze how much money will they save/spend by purchasing eco-friendly products.	Core subject related: Financial Literacy, Accounting and Personal Finance Management, using excel Environment related: Awareness of eco-friendly products in the market and about alternate lifestyle options

Table 1: Project ideas bringing together home science curriculum and environmental science developed for FY students

Images of the prototyping and play-testing (Source: Report HDGP11)

games, friends, schools, going to native place, their visits to the zoo, beaches and gardens. One group of students decided to take up Project 2. According to them, *"For this project we have created a game named Nature Trivia, which tells us about different environmental issues and their best possible solutions in a fun and interesting way. Board games play an important role in human development in order to improve mental health. This game is also a board game based on the theme of environment protection. This game will help to spread awareness about the importance of the environment among youth and help to motivate them to take small steps towards improving and solving the problems for a better environment."* (Report HDGP11)

The group developed a board game consisting of dice and pieces. The board has 32 squares and each one has environmental issues written on them. The players are posed with one issue at each square for which they are proposed 3 possible solutions in which one is correct and two are incorrect. Answering the correct solution leads to ownership of the said square and the winner is determined by who owns the maximum squares. The group claimed that they ideated several times before arriving at the game and even prototyped it with children and got their feedback.

Resource Management

Students probably found conceptualizing a hypothetical eco-resort a little difficult and therefore the facilitator adapted the project and made it an exercise to collect data on existing eco-resorts. 11 students chose to do the adapted version of Project 2. One group chose to do Project 2 as described (Report RMGP7). The students who chose the adapted version of Project 2 got in touch with eco-resorts telephonically and inquired about their various practices or in other cases, students just collated the information from their websites. After this, they compared the 3 eco resorts with each other and against a set of criteria that was described as pointers in the project brief. Some groups marked 'presence or absence' for certain criteria. For example, did the resort serve sustainable and local food? This was then marked as Yes/ No or marked with a dot or tick (Report RMSP5; Report RMSP9). In other cases, students developed a gradation where they marked a resort with a gradation-like score, using terms like 'needs improvement', 'can be better' and 'excellent' (Report RMSP6).

In fact, some students also reflected on their project and talked about how it brought about a change in their view. To quote an example, one student mentioned, *"My own view on the resorts changed while researching them. I like luxury and relaxation while traveling. After this report, I discovered how all luxuries and relaxation can also be achieved through these eco resorts. It made me want to travel to one of these myself and experience it first-hand. It was honestly an enlightening experience. It also educated me on how much carbon footprint is created by a single traveler on the environment every single time. We can make a lot of changes by just being a little environmentally conscious and being an eco-tourist."* (Report RMSP2)

One group who worked on creating a pamphlet called their eco-resort BMNITE ECO RESORT (after their college name). In the pamphlet, they covered some details related to facilities available in the resort with emphasis on how they are "eco" or environmentally sound. Other sections also mention recreational activities offered by the resort, and community service done to help the local population, and what kind of food they serve (Report RMGP7).

Textile and Apparel Design

Thirteen students took up Project 1 that involved making natural dyes from various organic sources. One student compiled information on natural dyes. Six students worked on upcycling textiles (Project 2). In the former cases, students tried dyeing the fabric with flower petals, leaves, fresh and used tea leaves, beetroot, turmeric, spinach, purple cabbage, rose and marigold petals, and even coconut husk. Some students also tried to dye fabrics using items like stones or seeds so as to obtain patterns on it (Report TADSP1). Some groups did a pre-wash and post-wash analysis to see if the natural dyes persisted or lost color (Report TADGP4). Overall, the majority of the students/ groups engaged in some hands-on practice with making natural dyes and using it to dye fabrics.

The students that worked on upcycling textiles attempted to actually make mat/rug apron, scrunchie, head band, money bag, masks, cloth pads, out of unused cloth strips, torn pieces of scarves, old mat and woolen threads. (Report TDAGP15/16/17/18/20). Interestingly, one student used a personal experience as a motivation to develop a cloth sanitary pad using old cloth as a means to address her medical infection/allergies. According to her, *"the cloths which were used and thrown by me during this time can be saved and also the old cloths which was ready to go to landfills are used in this process."* (Report TDAGP17)

Food Science and Nutrition

In this subject, environmental linkages were far more direct as issues related to farm to plate, sustainable agriculture, organic food waste and composting are well documented

and publicized. Three students worked on trying or developing recipes from what one might typically classify as 'food waste' like vegetable peels, etc. (Project 2). One student borrowed a traditional Andhra recipe for a chutney that used leftover ridge gourd peels, while the other made kebabs of the same. Another student made chips from Apple peels (Report FSNSP12). 12 students worked on microgreens (Project 1) and undertook short tasks like sprouting fenugreek seeds, moong seeds, mustard seeds, etc. Some then

used these in their recipes to make it tastier and more creative.

Student feedback

The core of any design-based intervention is its iterative nature which is a resultant of a reflective inquiry process (Christensen & West, 2018). In an attempt to strengthen the intervention in the upcoming academic cycles, a feedback form was circulated amongst the first-year students who engaged in the project work. Filling the feedback form was voluntary and we received 119 valid responses, which consisted of both BCA and BSc students. Initial analysis of the feedback responses indicated that nearly 76 per cent engaged in group work as opposed to working alone exclusively (24%), and just around 18 per cent of students felt the project work was easy or very easy. However, on asking what they considered difficult or easy, students' responses were divided. Students reported difficulty in collecting data (23%), writing the report (21%), doing the experiments (17%), finding information from the internet (15%) and interpreting their findings (18%). However, a similar percentage of students also considered collecting data (33%), writing the report (13%), doing the experiments (9%) and finding information from the internet (35%) as easy. When asked if they learnt something new from this project work, students reported the following (refer to the box).

Even though majority of the students (87%) claimed that they felt that global warming/climate change/environment pollution is related to their respective curriculum, very few articulated that connection. We did however find instances of students being able to break down larger sustainability issues to local problems. For example, one student mentioned, *"As my topic was upcycling food waste, we can learn how one can use more food ingredients or vegetables without wasting or minimizing wastage. And I think it can even go with the sustainable development goal of zero hunger and good health and wellbeing"* [G4]. Similarly, another student mentioned that *"There is a lot of food waste, textile industry causes a lot of pollution and fast fashion is bad for the environment, hospitality industry also causes pollution so yes every field is in some way connected to global warming or climate change"* [G33].

Around 43 per cent of the students reported having liked the fact that they learnt something new (knowledge and/or skills) in their field or regarding the environment. They also reported (11%) liking the topic and the idea of doing their project work in this area. Similar number of students reported liking (9%) and disliking group work (11%). On the contrary, students reported disliking parts of the data collection process (12%) and working online (8%). When asked how the project experience could be made better for them, around 35 per cent of students suggested that they could have more in-depth sessions, more guidance or mentoring sessions, exposure with experts, and more practical experience included. Around 56 per cent students reported that there was nothing that they disliked about this project work.

"I gained a little experience of how to speak with people and interview them." [G8]
"Yes, I learnt that in our day to day life we often use products that are very harmful for the environment but there are many other alternatives that we should use instead" [G25]
"Yes, I have learned to use the parts of vegetables we usually throw away and we can make tasty recipes out of them also." [G31]
"The project work helped me in improving my communication skills." [G44]
"It made me realize how the environment plays an important role in every sector and how much we take it for granted." [G51]
"Yes, a group project is not an easy task and sometimes you won't get along with members but still you need to do your best to the project success while maintaining unity as a group." [G62]
"Yes I have learnt to be more confident." [G64]

Discussion and Future Work

Environment is a topic that concerns all human beings. No matter what career path students choose in life, the environment is directly or inexplicably linked to their work and health. While the importance of being aware about the environment cannot be contested, one must also pay due attention to how these topics may be dealt with students, specifically at the undergraduate level. At this age, students already have nascent opinions and perspectives formed and are at a better stage to choose their career paths. Merely dabbling with topics around pollution and global warming may not be very relatable for the students who are already on their chosen track of studies. Further, esoteric conversations around environmental themes have their own limitations and they may not serve as enough motivation for students to take up projects in the area of environment unless they find it relatable. Therefore, it becomes imperative to infuse topics of environment within their UG curriculum in a way that is more relevant and contextualized to them.

Engaging in sustained projects within their curricular topics whilst touching upon environmental themes was a useful intervention. As one can see from student responses reflected in their project reports, students made personalized connections of the theme to their daily life, expressing a sense of self-realisation and awareness. They also engaged in several hands-on activities and engaged in problem solving. Some topics also provided an opportunity to think creatively in order to solve a problem. Further, many of the projects included scope to develop 21st century skills that are core to students' holistic development. They engaged in preliminary forms of data collection like conducting interviews and surveys. They also collated their data and made an attempt to interpret their data. Feedback from surveys also indicated that students felt that they had got an opportunity to develop their research skills, communication abilities, build their confidence and hone their collaborative skills. Further, they also reported being more aware of their environmental values. Based on their feedback, our way forward will include bringing in more expert or mentoring sessions to scaffold student projects. Since they are working on these new topics for the first time, more hand-holding may be needed at the initial stages which could be achieved by having more facilitative workshops on data collection methods, documentation and team building exercises. This could be achieved in several ways. Apart from external experts, the students may also interact with their seniors who would act as mentors for the junior groups. Additionally, orientation sessions for teachers to help in the facilitation and implementation of this interventional project work can be coupled with the student project work, so as to enhance the scaffolding process offered to the latter. Overall, these insights indicate that there is a lot of scope to include interdisciplinary topics at the undergraduate level. This is not only the requirement of the New Education Policy (NEP 2020) but also serves as a meaningful way to address environmental themes whilst keeping students' core curricula and 21st century skill development within scope of the intervention.

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