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The international student competition UrbanFarm: preliminary results from three-year experience

D'Ercole, R.,[1] Pennisi, G.,[1*] Durante, E.,[1] Carotti, L.,[1] Zauli, I.[1], Gianquinto, G.,[1] Orsini, F.[1]

[1]RESearch Centre on Urban Environment on Agriculture and Biodiversity (RESCUE-AB), University of Bologna, Italy

Abstract

Student challenges are becoming a paramount testing ground for the application of a number of innovative educational methodologies. Design thinking/case study, inquiry-based learning, project-based learning, gamification and distance learning are catching on in education systems around the world, enhancing students' ability to retain information and acquire new skills. The International Student Challenge "UrbanFarm", organized by the University of Bologna, has been an important opportunity to put these methodologies in place and observe and study their effects on students' learning process. Multidisciplinary student teams, with members from different Universities from all around the world, were asked to deliver innovative urban agricultural project proposals for the recovery of abandoned/vacant urban sites, by integrating architectural and technological innovations while pursuing social, environmental and economic sustainability. At present, while there are several international student challenges fostering student growth worldwide, and some follow-up surveys to assess their effect on participants were designed, disseminated and eventually analyzed, there is a lack of scientific work addressing the real outcomes of such challenges. The hereby study aims to quantitatively assess how participation in UrbanFarm Challenge has affected students' acquisition of new information, their ability to work within a multidisciplinary and international team, along with their future job perspectives. Furthermore, the study also assesses how the student's experience in the Challenge was affected by the ongoing pandemics. Data are collected through an online survey circulated to students from Universities worldwide, including both UrbanFarm participants of all three editions (2019, 2020 and 2021) and other students that did not participate in UrbanFarm.

Keywords: urban farming; student challenge; innovative education methodologies; survey analysis.

INTRODUCTION

Over the past few decades, all educational systems have initiated reform processes to adapt to changes in society. Accordingly, a shift from existing conventional or traditional class to more dynamic and responsive Innovative Learning Environments (ILEs) is observed (Byers et al., 2018). McCarthy and Anderson (2000) compared the outcomes of students taught by traditional methods with those of students taught by the active learning methodology. As a result, students involved in active learning achieved higher scores than those taught in the traditional way (Taneja et al., 2018). Therefore, it is deemed important to redesign traditional educational processes toward more dynamic tools. The teacher' purpose is to facilitate and accompany students in the learning process and simultaneously, getting the student's interest to facilitate the transfer of information and knowledge retention. New (student-centred) teaching methods play a crucial role in education as they contribute to students feeling respected as learners, helping their critical thinking skills, and encouraging their self-directedness (Wohlfarth et al., 2008).

Among the new teaching methods, Problem Based Learning (PBL) is a student-centered pedagogical approach that uses the analysis of a given problem as a starting scenario for acquiring new knowledge (Abdullah et al., 2019). Specifically, learners are actively encouraged to tackle the problem by independently deriving all the necessary information sources. Typically, learners are divided into groups, encouraging a collaborative problem-solving process, and incrementing teamwork skills. The teacher's role is that of "facilitator", the one who guides and monitors the group's progress during the various stages of learning. A joint discussion usually follows once the problem is solved, summarizing the progress and new concepts gained overall. This methodology encourages developing communication skills, problem-solving, critical thinking, teamwork, and self-directed learning.

The international student competition UrbanFarm is an example of the PBL approach. It is an international and multidisciplinary student contest hosted every year by the Department of Agricultural and Food Sciences and Technologies (DISTAL) of the Alma Mater Studiorum University of Bologna, in Italy (Orsini et al., 2019). Within UrbanFarm, students are called to rethink abandoned urban spaces and to design innovative food production systems while integrating best innovations in the field of technology and architecture. In order to design a functional and sustainable building, they should also consider circularity, e.g., by reusing materials and eventually reducing production costs or environmental impacts. Subsequently, they need to find strategies to reduce carbon emissions, harvest rainwater, and use renewable energy sources. It is important to consider the marketing part of the business, as managing costs is of utmost importance. Eventually, they must develop a project that can include diversified social groups, promoting inclusion and integration. This contest allows students to practice new challenges and test their problem-solving abilities while collaborating with peers internationally. Besides, the challenge helps students to boost soft skills as they need to familiarize themselves with problem-solving by combining different ideas and articulating decisions. This experience allows them to acquire a certain flexibility and adaptability to a group mindset. When in international teams, students learn how to communicate in a language other than their native tongue and their communication skills improve. Undoubtedly, they can progress in hard skills such as computer skills or the use of other digital technologies. Furthermore, dealing with deadlines helps them learning how to manage time more rationally. UrbanFarm targets students from tertiary education, coming from different countries, enrolled in diverse courses such as Agriculture, Biology, Architecture, Design, Economics, Engineering, Humanities, Social Science etc. The groups heterogeneity is fundamental because they are asked to elaborate on a project that involves every aspect of a sustainable business.

This research aims at evaluating with a survey the effectiveness of PBL initiatives building on the the UrbanFarm experience. Collecting opinions and preferences can help value if integrating the contest into everyday teaching is an alternative and appropriate way to teach in class how to design urban agriculture systems.

METHODOLOGY

Firstly, the target population was identified, and was composed by students at university stage, adults (>18 years old) and from different countries of origin, who participated in the challenge in the last three editions. A control group (with same features, but without experience in UrbanFarm) was also included. Factors such as age, gender, nationality, educational background, and study course degree were evaluated to consider an "environmental factor" that influences the development of abilities.

The experimental group was composed of students who had undergone the “treatment” (e.g., participation to UrbanFarm), whereas the control group was composed of those who did not receive the treatment, in order to detect differences. The variables of interest were observed over a frame of three years (from 2019 to 2021), throughout open-ended questions, multiple-choice questions, ranking and Likert scale questions.

The survey was composed of four sections - each with a filter question allowing students to go ahead and skip some parts. The survey proposes direct questions in a funnel-like sequence, starting with more general questions and then going into further detail. Furthermore, a short introductory paragraph informs the respondents about the aims of the survey and, a close-ended question asks for the respondent's permission to process the data and assess that they participate knowingly. Ultimately, the answers given were collected and processed anonymously.

The first survey's section collected personal data, and the second one explored their opinion about personal skills, teamwork experiences, international activities, and student contests participation. The option "Other" was added to multiple-choice questions to ensure greater freedom to the respondents and collect a wider variety of information. Consequently, the adoption of Likert-scales enabled to measure the level of student satisfaction. For statistical purposes, the measurement scale defined was a qualitative-quantitative one. On the scale of numbers from 1 to 5, each corresponded to a qualitative point of appreciation:

- 1, not very good;
- 2, barely good;
- 3, quite good;
- 4, good;

- 5, very good;

Additional sections of the survey focused on analysing students' prospects (section four) and experience (section five) within the UrbanFarm competition, the last one excluding the control group.

The decrement of the margin of non-sampling errors was optimised, limiting confounding factors such as the subjectivity of the answer or the question's ambiguity. However, other possible discrepancies could be due to the length of the questionnaire, which on average takes 30 minutes, as well as the reliability of memories far away in time.

The survey investigated each participant's individual experience, allowing a shared data pool and obtaining the students' average opinion. The procedure used was to collect outcome data about variables such as:

- The acquisition of new knowledge- the survey collected students' opinions about the easiness of acquiring new knowledge in the learning process and how it was affected by working in a team environment. The aim was to establish if teamwork can be an added value, as group learning allows the comparison of ideas and the clarification of concepts;
- Individual work vs teamworking- the survey tested students' preference/confidentiality to work individually or in groups;
- The implementation of soft skills/hard skills- referred to communication, problem-solving, teamwork, foreign language knowledge, and computer skills. The contest puts into work all these transversal skills. In addition, students should possess hard skills to put into practice when making videos, drafting papers and graphic design;
- Extracurricular activities- the participation in international activities such as contests, internships, international mobility (e.g., Erasmus grants) can affect personal development as they help to enhance personal skills;
- Job perspectives- how future job prospects have changed because of the experience, evaluating if it has heightened the probability to work abroad and in a team environment. On the other hand, it might have led to opening start-ups or meeting future co-workers/employers;
- The impact of Covid-19- the questionnaire collected data about how the students' participation in the UrbanFarm changed during the pandemic to establish if it can be classified as a distance learning method;

To sum up, the data collection procedure consisted of identifying the samples in the students' population, the production of the survey using the MS Forms software, finding the contacts, sending the survey by e-mails, and then analyzing data using Excel and R.

RESULTS AND DISCUSSION

A preliminary analysis of data collected showed that out of a population of 88 students responding to the survey, 46 people took part in the international student challenge UrbanFarm, while 42 people did not (**data not shown**). About 47 of the respondents were still attending a master's degree course, while 6 declared that they were no longer students. On the other hand, 11 of the respondents are attending a bachelor's or PhD (**data not shown**). The respondents came from different cultural and educational backgrounds, including both European and non-European countries, which makes it possible to measure the variables of interest in a broader context, with an international background. According to the trends, the majority of the respondents were Italian, followed by a smaller percentage of French, Egyptian and Brazilian. Furthermore, 16 people of the surveyed came mainly from Northern European and South-West Asian countries (**data not shown**).

Figure 1 provides an overview of the subject and country in which students completed their studies. Usually, UrbanFarm teams have a multidisciplinary composition in order to guarantee the elaboration of a good and interdisciplinary nproject. Those who studied in Italy came from different study degree courses, although mainly from Agricultural Sciences. About 8% of the participants belonged to studies in architecture, and smaller percentage were students coming from other disciplines such as social sciences, political sciences, or natural sciences.

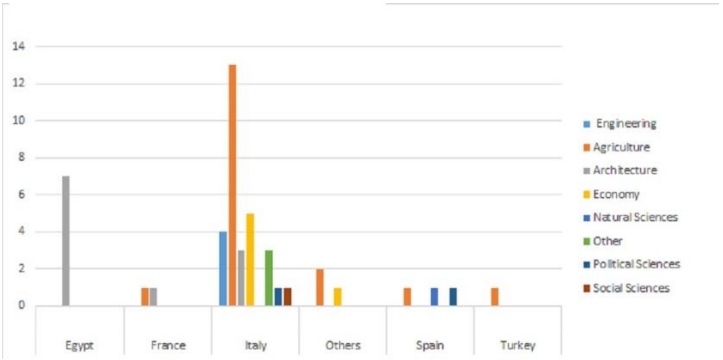

Figure 1. Distribution of UrbanFarm participants per country and subject of study.

One of the variables assessed was the students' skills, referring to both transversal and hard skills. Respondents had to rate on a scale from 1 to 5 how well they mastered specific skills. To assess significant differences between the two groups, the t-test was used, which measures the difference between the mean scores of the samples. From the results reported in **Table 1**, the only statistically significant difference was observed for communication skills, meanwhile no significant difference was detected in the development of other skills. Communication includes verbal, non-verbal, and written communication, presenting, writing, choosing the appropriate medium, giving, and accepting feedback, empathy, and active listening; students which experienced UrbanFarm claimed it was one of the best achievements associated with their participation to the challenge. The result on the communication skill self-reporting might be motivated by the fact that UrbanFarm aimed to boost those skills by presenting projects to an audience (including both experts and the general public) and working in a team. Other than that, students trained communication skills in other languages, including (but not only), fluency in English and other languages. Only 6 out of all the participants in the challenge indicated that they did not use another language than their native.

Table 1. Values of mean and p-value calculated on R.

	Control group	Experimental group	p-value
Communication skills	3.53	3.98	0.04
Foreign language skills	3.53	3.88	0.13
Soft computer skills	3.88	4.07	0.30
Hard computer skills	2.03	2.12	0.71
Problem-solving	3.78	4.00	0.18

Furthermore, the survey focused on perceptions about teamwork. During their career, students are often involved in teamwork activities such as preparing university projects, volunteering, extracurricular activities, research work and workshops. Respondents believe that group work is useful only if the group is small enough (less than five people) and that it helps improving the ability to work with others and to organise new ideas (**Figure 2**).

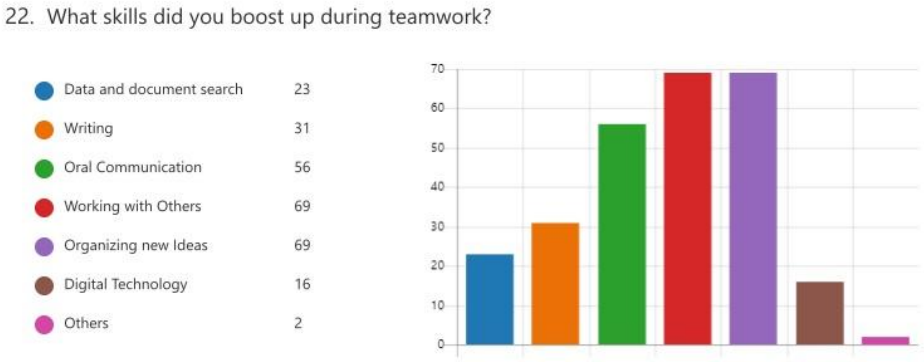

Figure 2. Skills that are enhanced during group work.

Concerning the international experiences, most of the survey respondents participated in international activities such as global challenges and competitions, student mobility (e.g., Erasmus exchange) and internships abroad. In most cases, they confirmed that the experience contributed to their personal development with an average quantitative grade of 4.5 (on a 1-5 scale) (**data not shown**). Half of them participated in at least one contest in their whole career, and about a quarter of them participated in more than one contest (**data not shown**).

CONCLUSION

Preliminary analysis of data collected prove that UrbanFarm played a role in enhancing students' skills. It allowed for challenging students and developing transversal skills but, above all, improving communication skills. As well as having a social character, UrbanFarm has enabled students to create opportunities, such as opening a start-up. Besides, it allowed students to become more involved in the learning process, showing more interest and engagement.

Further analysis should be performed on data collected, and population of respondents should be enlarged to give more credibility to these claims, especially by including participants from future editions of the challenge.

REFERENCES