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GreenTeam. A new educative approach to sustainable design

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Abstract: Sustainability, meaning its three pillars, social, economic and environmental, is by now a prerequisite in the design phase and one of the mandatory topics in educational programs, both for future designers and other professions. This happens even more if the project theme concerns mobility or waste management, fields in which daily behaviours impact on the system, the ones adopted by teenagers as well. Is it possible and correct to use an academic teaching methodology, based on participation and learner-teacher mutual exchange, that usually works with adult and motivated people, with a group of high school students? If the actors of the system already adopt sustainable behaviours for contingent reasons and lack of resources rather than the real will and awareness, what are the actions to be taken? The paper answers these questions through the analysis of a direct experience of the authors: GreenTeam.

Keywords: sustainable design, sustainable mobility, waste management, constructivist approach

1. The need for sustainability in the educational field

Until a few years ago, designers could consider or not the environmental issues related to the project, consequently by adding or not the prefix eco- to the project (eco-design). During these years the attention to the impacts and to the repercussions on the environment became not only unavoidable (Tamborrini, 2009) but the concept itself of sustainability has been enhanced, including social and economic aspects (Thomsen, 2013). Some might say that this is a one of the peculiarities of design, that tends to expand more and more the limits of its research field, often generating criticisms or misunderstandings with other professions (Åkermark, 2003). Actually this allows the designer to free himself from the only measurement of technical or technological aspects in order to consider more carefully the causes and consequences of behaviors. This is a field whereby the design can have not only a strong influence but that has always been monitored to inspect, or at least foresee, trends and hidden desiderata of the involved actors. According to this perspective, the design, depending on the specific stage of the process, shifts from managing the complexity, to the building of relations between actors in a systemic way (Bistgnino, 2009), to the multidisciplinary dialogue, to the thinking in a across-the-board way to define the concept. The understanding of the possibilities, the opportunities and, consequently, of the duties which belong to the designer

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necessarily passes through a training program that allows future designers to learn methodologies and best practices. These can positively condition the actors who come into contact with products and services they will design. When these concepts have to be imparted to students of a bachelor or master degree, teachers should have a well consolidated methodology or approach. Can the same methodology be applied, however, to different cases such as students of a high school? As the paper will describe below, communicating to teenagers the importance of the paradigm of sustainability is crucial, just when their age and their growing maturity allows the creation of definite and decisive opinions for the rest of their lives. The GreenTeam experience had indeed an educational purpose, but has mainly experimented whether an activity chosen by the teenagers must necessarily be a pure transfer of knowledge.

2. The GreenTeam project

GreenTeam is a project, today in its second edition, that involves three promoters: the Maxwell Institute, Politecnico di Torino, the City of Turin. The main goal is to create small groups of high school students to work on the issues of sustainability, declined in four areas: comfort, energy and water, mobility, waste management. In particular each group has to reach a level of expertise and awareness on the debated issue and then develop a project that should have an outcome, in different terms, on the school. The participation to the working groups is not compulsory for students, it is a proposed activity that gave to participants scholastic credits. Groups are composed of a maximum of eleven students (waste management group) and a minimum of four (energy and water group), based on the free choice made by the students. The activities took place in an agreed location and involved students, academic tutors with scientific expertise on the field, two high school teachers that accompanied the students. The project provides a base of ten meetings of about two hours each, other hours were added for self-employment of the student teams and for helping particularly eager group to complete the project. Specifically two teams (comfort, energy and water) were followed by professors and researchers of the Politecnico di Torino's department of engineering; the two teams mobility and waste management, whose experience is described below, have been followed by researchers in design. It should be emphasized that the high school has already developed a number of initiatives to make its buildings energy-efficient and environmentally sustainable like, for example: a solar wall which is a device for capturing solar energy and heat that can warm up the air inside the gym; a photovoltaic array that provides power to the equipment of the school; a solar tower; a display that communicates real-time energy consumption of the school.

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3. The set up of the work process

This section describes the experience of the two design-driven teams (mobility, waste management) directly followed by the authors, starting from the methodology and the planned work process, ending with the results achieved by the teams and the feedback from students who participated to the project.

The methodology usually taught at the Bachelor's degree at Politecnico di Torino is divided into highly iterative steps. The courses are divided into modules of six or twelve months and follow the framework in Figure 1 (Germak, 2009). As you can see, the steps include a substantial initial phase that includes ex-cathedra lessons, warm-up and the construction of scenario. The term warm-up does not appear in the text and in the mentioned scheme, but during the early stages, especially in the first two years, students require initial support to start the research stage and scenario's construction. In this phase, in fact, students should primarily take note of complexity in which the project will develop, in order to expand as much as possible their vision. According to Enzo Mari, this phase could widen as an endless spiral, but if designers that work within large companies, with very

strict processes, are usually forced by management's timing to stop the continuum, this never happens during the didactics. Especially in the current historical period in which tech-companies churn out new products and services on a daily basis, it is not recommended to completely abandon this activity until the end of the project in order to avoid the design of not up-to-date projects.

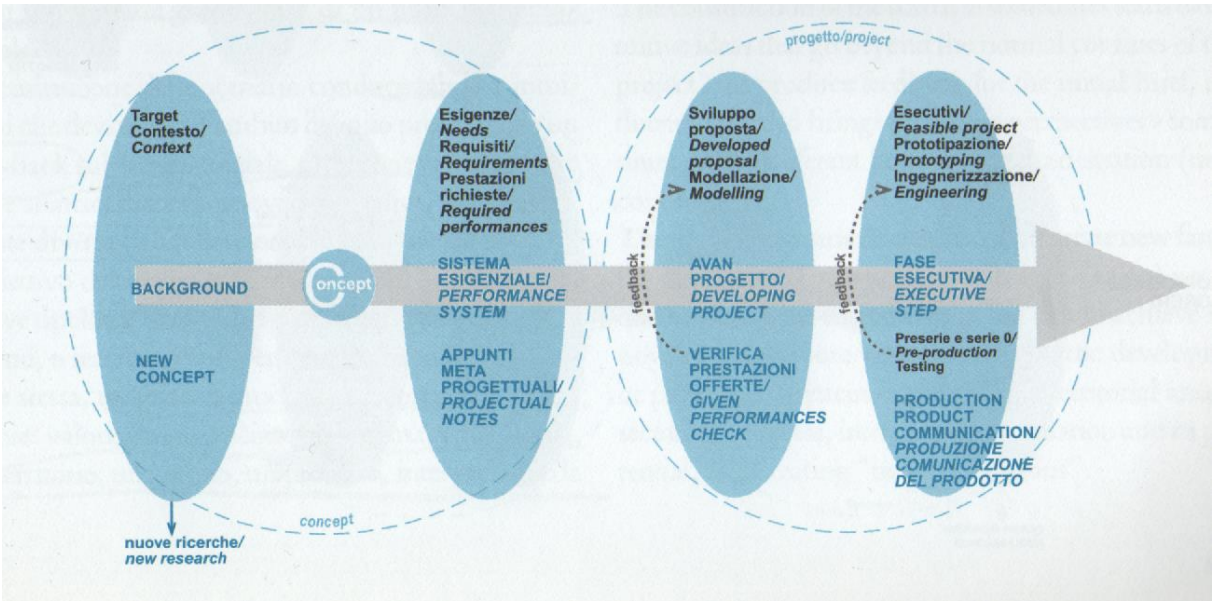

Figure 1. One of the possible paths that design students can follow according to the Politecnico di Torino's Design Methodology (Germak, 2009)

Students of the degree program are usually encouraged to adopt a scientific approach that includes the finding, the study and the systemic analysis of articles, books, data available in various forms: from online reports about the state of the art to the creation of ad hoc questionnaires to assess the perceptions or the requirements or the desiderata of the involved actors. This does not eliminate an approach on the field or hands-on, which is encouraged and excellently evaluated. A similar approach, however, could be difficult to perform if projects are complex and if there are many involved actors, causing an increase of the distance between young designers and the project they are facing. After completing the scenario, the future users of the product or service are usually analysed, then a chart is set up a to communicate the new product concept, a table is set up to take note of needs-requirements-performances, after that there is the project phase divided into draft project and executive project. The draft project moves from the offered-performances to the selected-performances for the project, the executive project phase specifies every detail in order to make it feasible and producible through the use of prototyping and engineering.

During the degree program, the completion of all the steps requires not only different timing but also: a lapse of time to learn the method, a culture and a keen interest in the world of design, representation skills and of a series of key factors for the success of the project.

The GreenTeam project issues provided the opportunity to verify the quality of a methodological framework making some adjustments to mold it in a different context. In particular the crucial points were: the specific outputs of the project, the timing, the project's targets. The output of the project was not specified at the beginning of the activity. This has somehow left a decision-making freedom to the teams, the only required emphasis was to obtain impacts within the school itself. The academic tutors, with the two design teams, tried to mediate between the ambitions of the students, their actual skills and the time of realization. For these reasons, the part of hands-on research was made as visible and accessible as possible and became part of the project's output.

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The available time to the team had limited all stages, preventing both the development of too articulated project concepts, even if correct, and the level of detail usually reached during an academic course. However stimulating a personal and group experience circumscribed, for example, the number of case studies, but it also prevented the characteristic phase of bewilderment the students encounter during the construction of the scenario.

The target of the project is a critical issue because it can be perfectly superimposed to the project group, but this is interpreted as part of the knowledge acquisition process in first person towards sustainability. This interpretation is in line with the constructivist approach (Von Glasersfeld, 1988) that requires not only an active participation of the students but also a learner-centered (Varisco, 2004) structure of the work. Referring to the five approaches proposed by Gardner, the design teams adopted at least the narrative one, the philosophical-conceptual one and finally the experiential one (Morgan, 1996).

In particular, the two design teams tried to comply with the Jonassen's guidelines working towards: the construction of knowledge; the representation of the complexity that consists of multiple visions; the provision of tasks and in-depth analysis arising from the real world; the encouragement to reflection reasoning through dialogue with working group (Jonassen et al., 1999).

During the first years of the degree course, university students usually aspire to a fast acquisition of technical and technological skills and to the learning of specific software. While this is undoubtedly professionalizing, design teaching should provide also a careful study of the grammar of representation and formal language theory. In this project, however, the presentation and representation of students' thought and work has been appointed to digital storytelling in order to foster the experiential factors (Arcagni, 2016). Digital storytelling is a concept that had in recent years a rapid rise and spread. It refers more to the way in which the narration is realized than to the narrative content (Bruni, 2012). Due to the wide spread of digital technologies, in fact, digital natives have the ability to create content in a language they consider natural, through the use of devices (such as smartphones and tablets), using software and applications that enable a fast editing of an audiovisual product. These tools have been adopted during all the phases in order to promote the expression and sharing of individual experiences avoiding as much as possible a mediation between thought and language. This last statement could be criticized from the educational point of view because this approach does not teach one of the main strengths of the designer: the language of representation. Actually it will then be recovered during the implementation phase and the project communication, although in a more agile and condensed version.

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4. The two experiences: sustainable mobility – waste management

This section will outline the two parallel paths of the design teams. The goal is to show how such different issues can be addressed with the same methodological structure even outside of an academic context.

During the first phase both groups have been involved in the construction of the scenario that has been developed first with a hands-on mode and narrated using digital storytelling, than a discussion group has been opened to reflect upon the fundamental concepts and the related case studies. Specifically, the students of the mobility team have been encouraged to produce a first-person account of the way they move to and from the school. The accounts were very different both in the modalities that regarding the final results. Three members of the group made a video to tell their journey to the institute, a point of view video, shot with the screen of the smartphone in portrait position, with a live voice over to comment what was happening. The three videos were edited

respecting the temporal sequence of events, often speeding up some frames to avoid the lost of the continuity. Videos usually have an ironic music soundtrack, almost to dampen all the difficulties encountered during their journey; one of the students, for example, every morning takes almost two hours to reach the school and she has to leave the house at 6 am. Other outputs were: a short story, which has been also narrated in POV and showed the desire for a more comfortable and safe mobility; a kind of video interview. At this point, after viewing and discussing together every single experience, the team decided to realise a survey to better understand the situation and the context in which the school is included. In this way students studied first the location of the school inside the mobility system and connections (Fig. 2), in order to create a questionnaire (Fig. 3) to be submitted to their classmates and professors. The team decided to create questions about the used means, the perception of the journey, the behaviours during the trip, the wishes, the factors that influenced the choice of the means of transport. At this point it is necessary to emphasize two aspects. The first one is that, except for adult students (the ones who attend to the fifth year), none student owns the driving license then a low percentage of them can choose the car as a means of transport; this places the students among the most sustainable actors of the system but also among the ones who desire most to be independent gaining the right to drive their own car. The second aspect, unexpected for the authors, is the failure of the digital tools, as regards the administration of the questionnaire. During the previous edition, a questionnaire with more general goals had been administered using a web platform. The completed questionnaires were, however, only 149, most of them were incomplete and students complained about too difficult questions and obscure language.

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Figure 2. Picture of the mobility team working at the scenario, analysing the connection between the high school and the surrounding context

The working group discussed and agreed on a different kind of language (less technical and closer to their goals), question wording and the mode of administration, in order to gain more significant results. This led to a kind of door to door administration, the team delivered a printed copy to all classes. The result has been an almost total coverage of the students, 594 of a total of 650, this led to an immediate interest in the entire school both on the mobility issue and on the work of the group.

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The same results of the questionnaire, analysed to date from the quantitative point of view, were useful to the project also for: the presentation to the involved actors (the school system is composed by students, teachers, parents, directors; the municipality and the metropolitan city in which it is inserted, the public transport company) in order to demonstrate the importance of a deep reflection with the subjects that will face very impactful choices in their coming years; the analysis of the users. In parallel, the waste management team has carefully surveyed the produced waste by: interviewing the school staff involved in the collection, testing on a a sample of baskets if and how the school did the necessary actions for the correct differentiation of waste. The debate within the group has been extended to the teaching staff and the school management. This allowed a discussion that highlighted a number of usual preconceptions: each actor attributed the malfunction of the system to another actor: the students singled out the cleaning staff, who in turn complained of ineffective management etc. Actually, after the first moment, each actor highlighted a different awareness and the availability towards the improvement of a system that, albeit with some lack of management, was at least projected.

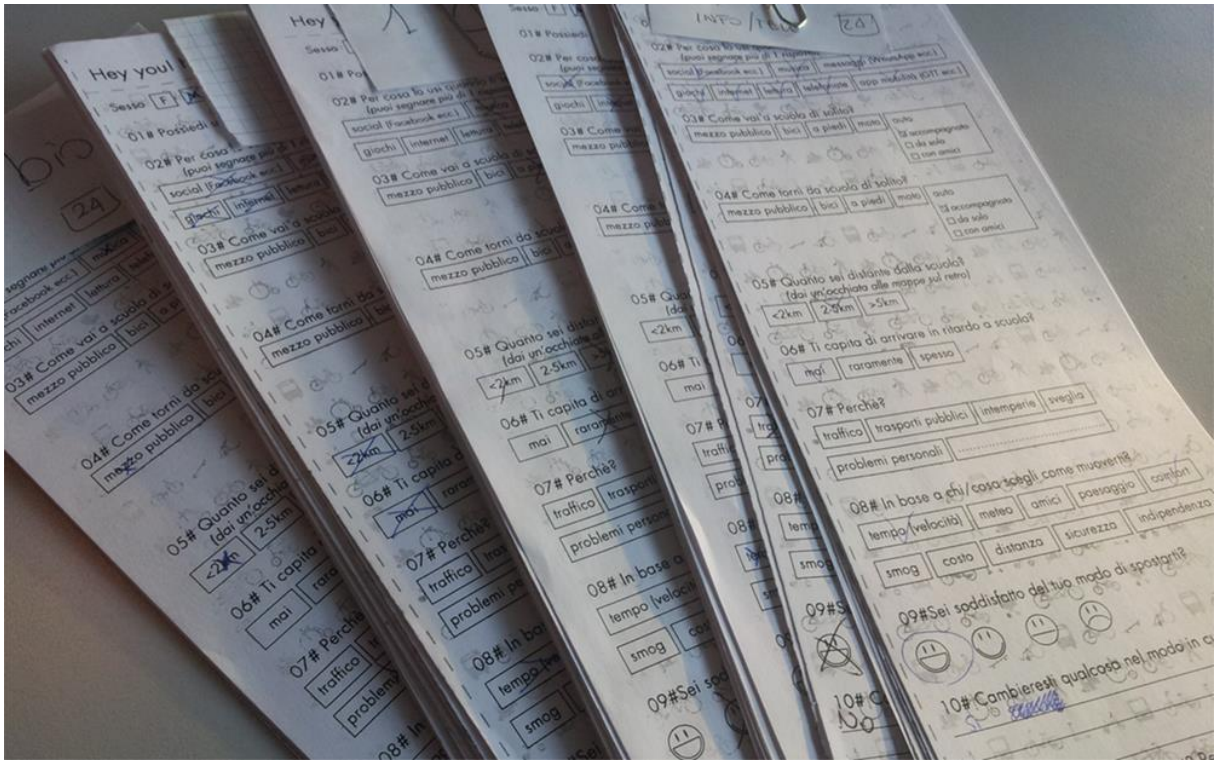

Figure 3. Picture of the questionnaires (a small part of the 590 copies) administered to the students of the high school.

This renewed attention on the issues can be, of course, a consequence of the Hawtorne effect (Adair, 1984) and it is not predictable how long it will last, however the shift of the focus from complaints to the design activity is an important result of the project. Furthermore the team operated an investigation into the ruined and unusable equipment within the school. This category includes: cabinets, school desks and chairs, wooden boards and boxes, electronic equipment, metal tubes. At the time of the investigation all this stuff was stacked in areas closed to the school building. The stuff have been quantitatively classified in order to start the correct disposal (e.g. for the electronic equipment) and to begin the design of a possible re-use of materials, when possible. It should be emphasized that both activities were carried out when the school was full of students, creating an immediate and positive dialogue between the students and professors, who both felt as an active part of the project. Moreover, these investigations allowed not only to obtain quantitative data on waste generation and disposal, but also pushed the school management to adequately store

materials and to envisage other use. During the investigation stage the team has organized itself to document some of the key part the work through photographs and video, shot with students' personal smartphones, in order to create a database for the final project. Once obtained these first results related to the context and the territory, both teams started a phase to compare other kind of similar experiences. This has been developed half in groups together with academic tutors, and half leaving the group to self-manage the research. The activity with the whole group was useful to suggest some research tools, watching, evaluating, and sometimes advising about magazines rather than articles, graphic novels or other credible material, that would enlarge and enrich the scenario according to the interests of the single student. The waste management team, for example, worked to find some good examples on recycling, reuse and self-production of objects with waste materials. The mobility team, instead, compared other alternatives for mobility in the territory by stimulating questions and research on services such as sharing and pooling. After the schematisation of all the gathered information about the two systems, the teams dedicated themselves to the creation of the concept. The academic assignments usually include a briefing, or at least are part of a given field research, in this case at first the group has been left completely free to imagine any kind of concept, to continue the flow of discussion between the students. Later, after having reorganized and created a map of the possible concepts, the concepts have been sifted out using the already mentioned criteria of the available time and the students' skills. The concepts that have been evaluated and rated as the best by the group have been then deepened and designed during the last phase.

The other concepts that were too complex like, for example, the smartphone application to create a sustainable mobility community fitted for the school, rather than digital platforms to encourage and share the results of the projects, have been neither rejected nor criticized but always discussed. The aim was, in fact, to bring the concept to a recognizable level, even if embryonic, in order to stimulate the creativity of each student. The concepts that were discarded as too complex, or expensive in terms of resources, however, have became part of the agenda of the next year edition of GreenTeam.

The two concepts that have been selected are: a widespread and cross-media communication (mobility team); the realization of a system including a greenhouse, a tank and a composter (waste management team).

The waste management team designed and built by hand the three elements in front of the entrance of the school, using part of the previously surveyed materials. Students created new positive relations with other professors of the school that made themselves available especially in regard to the design of the structures.

The mobility team, instead, designed and realised two posters that represent the chosen pay-off: "let's move with the right taste" (Fig. 4). The project was conceived in order to be posted inside the school premises and to be digitally sent using the personal devices of the students. It has also the ambition to be published on other media such as institutional web channels, rather than on the displays placed at public transportation stops. The produced objects, as well as the poster should not be evaluated in itself, but on the contrary, they are the point of arrival of a design path in which the dialogue, the experience and the satisfaction of the group are by far the most important.

The project ended with the communication phase.

Two events were organized in which all four projects were presented to all the actors mentioned above. For the occasion, both design groups created a presentation that contained the whole story based on digital storytelling. In particular, the waste management group designed, shot and edited, with the support of academic tutors, a videoclip (Fig. 5) to ironically describe the project in the form of more complex story, mixing the fast language of videoclips with documentary images.

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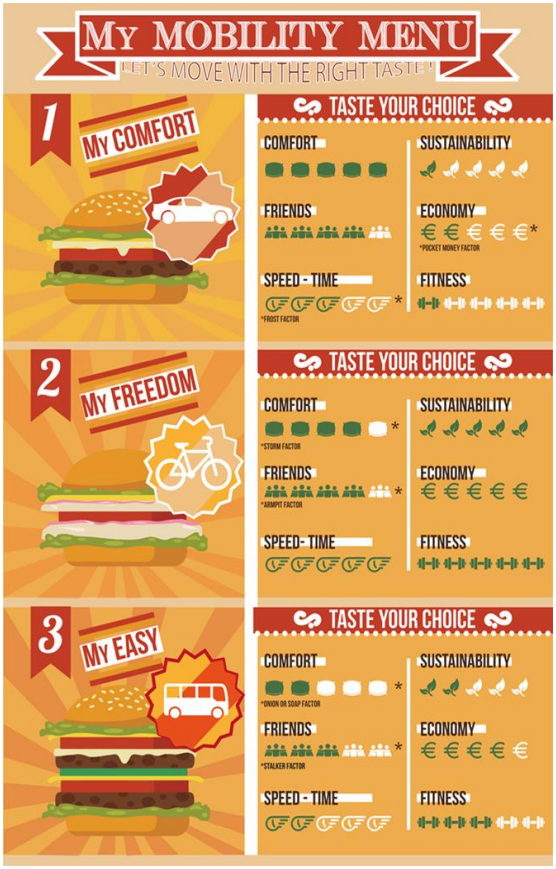

Figure 4. One of the posters designed by the mobility team. The used graphic language has been chosen by the students to attract their mates and then, with a second level of reading, make them reflect without giving an authoritarian message.

Figure 5. A frame of the videoclip produced by the waste management team, here the greenhouse is still under construction

5. Conclusions

At the end of the GreenTeam edition, the methodological approach applied to the high school students was able to lead the project in the desired ways. This is confirmed from the academic point

of view, because the project results have been achieved, because all the involved actors expressed great satisfaction and the project will have another edition the next year. Moreover the students who participated in the project were rewarded with a trip from the management of the school. The methodology, with the necessary corrections, proved to be solid if adapted and shaped on a different actors. The word "shaped" does not mean "simplified" or "impoverished", indeed, the achieved results are comparable to those required during the first academic year.

To get a personal feedback from the involved actors, a brief questionnaire was administered to students of the team and to professors. They pointed out that the greatest difficulties arose: regarding the timing, when the work was carried out after the school time; the lack of involvement of other experts or stakeholders during the design phase. Both students and teachers of the school affirm, instead, in all cases: that working in team as very stimulating; that the interaction to decide the project's goals is very positive; that they discussed about the project this in a positive way with friends, classmates and family; that they recommend this experience; that their daily routine has been influenced by the project.

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