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Tutors' perspectives on NPO collaboration in industrial design education

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Collaboration with NPOs in Industrial Design Education:

A Study on Tutors' Perspectives

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Non-profit organisation (NPO) collaboration in industrial design education enables tutors to bring real-life problems to the design education context. Only in recent years, good practices of NPO collaboration implemented in the studio and elective courses are seen in industrial design education. Within the scope of this paper, 20 tutors from 10 industrial design departments in Turkey who have carried out educational projects in collaboration with over 30 diverse non-profit partners in their undergraduate courses were interviewed. Based on the thematic analysis, this paper explores design problems studied in collaboration with NPOs in the context of industrial design education together with tutors' perspectives on the motivations of actors for collaboration, and the benefits and challenges of collaboration. This paper offers three collaboration models on NPO collaborations in education and aims to achieve an extensive and outsider point of view rather than a restrictive, case-specific, insider viewpoint towards these collaborations.

Keywords: collaboration in design education; university-NPO collaboration; industrial design education; design for non-profit organizations, collaboration models

Introduction

Design practice is currently improving itself through new areas, skills, approaches, and methods. Considering the expectations from 21st-century designers and industrial design definition of World Design Organization (WDO), there is a shift in the direction of interdisciplinary collaboration, innovative and sustainable product, system and service development, strategic planning, and human-centred design (Beucker, 2004; Kolko, 2005). To respond to this shift, design departments and tutors should take a different role to raise better students equipped with the necessary skills (Augsten & Gekeler, 2017).

WDO's definition revealed that industrial design has integrated product design with many design-related fields, such as system, service, and user experience design. New design-related areas of study have been emerging and the roles of industrial designers have expanded while pure product design role has declined. Design is evolving from building objects to involving design experience, services, and processes (Sanders, 2006; Suri, 2003). The fastest-growing areas of design include interaction design, user experience design, service design, and transformation design (service design of social systems) and the new roles and responsibilities of designers arose accordingly (Kiernan & Ledwith, 2011). Therefore, designing processes are penetrating through the community, and resulting in an increased rate of new approaches and methods used in these areas (Broadbent & Cross, 2003). The approaches and methods as user-centred design, participatory/co-design, inclusive design, design for sustainability, and multidisciplinary teams are used in these newly emerged areas (Kiernan & Ledwith, 2011). The scope of design practice has advanced, broadened, and blurred its borders; hence design education should be reformed according to this transformation.

The definition of WDO (2015) also emphasizes the trans-disciplinary nature of the design profession that supports and encourages co-creation. During the collaboration, designers are fed by other's abilities and know-how while bringing them a designerly way of thinking. Currently, design problems are solved faster by the collaboration of multidisciplinary specialists and users through the processes (Seidel & Godfrey, 2005). Since the globe turns into an interdisciplinary habitat, to make students qualified in interdisciplinary collaboration

and peer learning, industrial design curriculum should train undergraduates to inquire, understand, make a judgement, debate, and reach an agreement while collaborating (Niederhelman, 2001; Kaygan & Demir, 2017). Hence communication and discussion among peers, and collaboration skills of individuals could only be enhanced through practice within design education.

Industrial designers are hoped to serve non-profit goals and to touch social matters by reducing the difficulties that people face who are physically disabled, elderly, homeless, unemployed, or the societies living in third world countries (Davey et al., 2005; Diehl, 2009; Ramirez, 2011). For years there has been a discussion among educators that designers should not only focus on increasing the profits of companies they work in but also being socially responsible (Yang, 2015). A "social model" instead of a "market model" for design education and design research is suggested. The skills that social designers should carry and how students should be taught so that their product designer skills can fulfil human needs while being productive on societal values are discussed (Margolin & Margolin, 2002). A suggestion to boost the social aspects of design students might be collaborating with non-profit organizations (Yang, 2015).

Project-based learning (PBL), called "experiential learning" by (Kaur Majithia, 2017), is one of the most preferred approaches in higher education. Accordingly, PBL has been advancing and spreading amongst universities (Augsten & Gekeler, 2017). This student-oriented teaching and learning pattern in design education prepares students through problem-focused, active and experiential processes of complex real-world issues from either industry or civil society in inter-disciplinary contexts and helps them to obtain information and to create purposeful solutions (De Graaf & Kolmos, 2003; Jonassen et al., 2006; Hansen & Lehmann, 2006). Due to the project-based learning nature of undergraduate industrial design education, collaborating with external partners is a common approach.

Many reasons make the implication of collaboration between university and NPO in industrial design education so essential. University-NPO collaboration offers potentials and strategies for design collaboration in the educational context and provides numerous subjects and content for the projects that will be conducted, covering product, service, and experience design areas. It also provides opportunities to teach and apply many methods and approaches in these fields. Thereby, this collaboration could enhance the link between design education and design practice. Concepts of collaboration, social responsibility, and design thinking have been gaining even more importance worldwide. The 21st century's desired industrial designers need to be raised to become both socially conscious for real-life problems and open to collaborative work. Therefore, it is inevitable for design education to engage students in collaborative projects and processes with non-profit partners. Recently, the collaborations between industrial design departments and NPOs have been rising. Due to the increase in university-NPO collaboration projects in undergraduate industrial design education, the topic is matured enough and worth researching.

Nowadays, forming teams made up of collaboratively working professionals and specialists from different disciplines and institutions, is a common strategy to solve complex real-world problems. In the related literature, there are two main classifications on terms related to collaboration depending on disciplinary (Dykes et al., 2009) and organizational (Wang & Oygur, 2010) frameworks.

From an institutional point of view, as individuals' departments and organizations differ; four types of design collaboration were identified: mono-departmental, intra-organizational, inter-organizational, and extra-organizational (Wang & Oygur, 2010). Inter-organizational collaboration is a collaboration that exchanges skills and proficiency between multiple institutions on a certain design and it brings not only improved performance but also brand-new applications (Li & Williams, 1999; Pisano & Verganti, 2008). Inter-organizational collaborations provide meaningful outcomes for collaborating organizations (Hardy et al., 2003). University-NPO collaboration is an example of inter-organizational collaboration. It is lately demonstrated that consultation from final users of the products or services has become an important asset for design practices; that is extra-organizational design (Redström, 2006). Architecture, interior, and environmental design also benefit from the participation and inputs of end-users which proves the emphasis on end-users on designed products and services. Co-creation and design ethnography could also be counted under the roof of extra-organizational design because both are aided by end-user's direct requirements, experiences (Sanders & Stappers, 2008). Designer, NGO, and local people collaboration in participatory design projects can also be defined as extra-organizational (extra-institutional) partnership because they involve in a project with the same expectations and intentions (del Gaudio et al., 2016).

University (design department)-NPO collaboration in education could be considered as interdisciplinary, transdisciplinary, and inter-organizational collaboration. On the other hand, it can also be defined as individual students or a group of industrial design students who work on a design-related task to achieve, and professionals from diverse disciplines and organizations (institutions) who help them to achieve their educational goals through collaborative processes. These collaborations might offer mutual benefits for actors

engaged in. However, rather than a shared goal, there are educational objectives that are mainly students' duty. So, the reasons for collaboration in the context of education might include preparing industrial design students for future professional environments.

Methodology

This study aims to identify topics, motivations, and challenges of collaborative design projects with NPOs, from the tutors' perspectives in the industrial design departments of universities in Turkey. Non-governmental organizations (NGOs) such as associations and foundations, civil initiatives, educational institutions, and local governments (e.g. municipalities) are the non-profit actors of this study.

In the first phase of the research, to access the universities and NPO stakeholders involved in collaboration processes in an educational context, an online questionnaire was prepared and sent through an email to the heads of industrial design departments of 30 universities in Turkey listed on the website of Council of Higher Education. The emails briefly explain the area of interest and the aim of the study, and kindly request either filling in the form or sharing it with the related tutors.

In the second phase of the research, 20 tutors from 10 universities were interviewed. The interviews took one hour to three hours. All interviews were audio-recorded and transcribed into textual format. Descriptive coding (Saldaña, 2009) and template analysis (King et al., 2012) methods were applied for analysis. Descriptive coding (i.e. topic coding) method can be used to summarize the content for a detailed inventory of qualitative data forms like interview transcripts.

Topics Studied in Collaborations

The study covers student projects conducted in Turkey between 2009 and 2019 which were reached within the scope of a Ph.D. Study. To reveal the subjects of collaborative projects between industrial design departments and various NPO partners, collected data is categorized according to the design problem areas and the aims they focus on. The topics of NPO collaboration projects in an educational context are classified in accordance with the key issues they address as (i) projects related to special groups, (ii) local development, and (iii) environmental projects. The boundaries between categories are not so clear since some projects address multiple issues.

Projects for Special Groups

This category includes a variety of projects developed for special groups to provide specialized design solutions for every individual in society. The disadvantaged groups are disabled people, refugees, women, or people at different age groups like children and elderlies. One of the earliest examples of this category is developing product ideas that ease the daily lives of the elderly who live in a neighbourhood nursing home.

Most projects in this category concentrate on children as a user group. One of the product examples is an educational board game that intends to make children think, discuss, and learn about their rights. Another is a system that turns a mobile phone camera into a microscope. Some of the collaborative projects specialised for children are sustainable hygiene washbasins, school door handles and accessories, playful and engaging sustainability scenarios for fostering children's saving habits, and encouraging children's sharing behaviour. Other topics for disadvantaged children include designing and producing prosthetic hands for children with limb deformity which are customized for holding a pen to draw and paint, playing the drum, and suggesting activities for children of migrant families who live in a removal centre.

To ease the lives of disadvantaged people, some examples focus on designing objects that people with rheumatoid arthritis can use in their daily lives, furniture for disabled people to provide a better quality of life, and empowering disabled persons and carers in a neighbourhood. Another project for disadvantaged groups aims to reduce food waste by rescuing surplus food and making it available for the people in need via a design solution that aids the process of daily food distribution and sharing. An experience design topic studied in this category tries to reflect a physical or mental disability to a person without disabilities so that they can emphasize with disabled individuals.

Projects for Local Development

This category includes collaborations with local governments (i.e. municipalities) and other local partners to provide and sustain local development. The earliest example of this category was designing concept products for a cittaslow in line with the Movement of Cittaslow. Other collaborations with municipalities like designing urban furniture, safe playgrounds and equipment, and sales units for marketplaces that can be used in village festivals aim to improve the services of local governments. Some projects focus on the needs of particular local

areas and people living there such as creating a dream neighbourhood and a neighbourhood identity, selecting a rural site as a field, and developing sustainable design solutions to improve that region in collaboration with multiple partners.

Environmental Projects

This category includes diverse environmentally responsible projects emphasizing the significance of post-use, reuse, recycle and waste management. One of the earliest examples of this category focuses on the reuse of worn-out tires with the technical and logistics support of the collaborating association. This example also deals with designing urban-scale public socialization spaces and outdoor products in these areas such as furniture, playground, and equipment to raise public awareness and inform the society about re-use of these worn-out tires. Another environmentally concerned project to encourage post-use, recycle and waste management is a mobile kiosk that aims to promote the reuse and donation service of a municipality. Another is a system design that involves the collection and distribution of reusable and second-hand shoes, clothes, home textiles, toys, and books to raise awareness of sharing. As the latest instance, a recycle bin for several recyclable materials is designed as a part of the zero-waste management policy.

Motivations of Actors and Models of Collaboration

When the related literature was searched, the theoretical frameworks of academic-NGO collaboration are classified according to collaboration initiation (Roper, 2002), collaboration intensity (Ross et al., 2003), collaboration perspective (Sullivan & Skelcher, 2003), and organizational relationship (Sullivan & Skelcher, 2003). This paper accepts Roper's (2002) typologies of initiating academic-practitioner research collaboration. In this study, this typology is extended as driver-based models of educational collaborations between universities and non-profit organisations which are tutor-driven, NPO-driven, and student-driven. The rationale behind the word 'driven' is to express the motivations and expectations brought by the initiator or the driver into the collaboration.

Tutor-driven Collaborations

Tutors form a collaboration based on educational and personal motivations. When tutors initiate a collaboration with NPOs, they pursue educational goals, which are the knowledge and skillset they want to provide to students. These collaborations enable future industrial designers to be trained with certain qualifications. Eight of the participants interviewed were involved in tutor-driven collaborations and shared their experiences about this model.

Through these collaborations, the aims of tutors can be listed as follows (i) introducing, teaching, and applying new concepts, approaches, and methods in design, (ii) guiding students' design for a special user group, (iii) expanding projects' scopes from product scale to system, service, and experience (iv) developing students' collaboration skills in team working, in inter-disciplinary and inter-organisational contexts, and (v) emphasizing on the social aspect of design in undergraduate industrial design education. Along with these learning objectives, tutors' personal interests and motivations towards social, environmental, and economic issues also trigger the reasons for collaborating with NPOs. When tutors establish collaborations, the subject that they could work on is determined by them as well, at the beginning of collaborations. They share their opinions with collaborating partners and discuss them, while NPO partners help to further elaborate through recommendations.

Being alone while doing projects within a studio environment, or at a university campus without any real context is criticized by tutors, as they feel that they justify themselves. They call this self-criticism of being in an ivory tower. When they leave their comfort zone and question what can be done, they realise that they need an external reality that NPOs can provide especially when studying subjects like sustainability. Collaborating with external stakeholders also brings an opportunity to carry out participatory, and co-design studies. As well as contacting on purpose, meeting with someone in design competition juries by coincidence can start interpersonal relationships and lead to collaboration. Tutors want students to develop design projects that have a strong connection with real-life for an existing need. NPOs bring real context that helps tutors and students to better implement and achieve their educational purposes.

Some of the tutors do not follow a conventional design process within the scope of these collaborative projects, as they aim to apply new approaches and methods. Among the tutor-driven collaborative projects, new concepts and approaches introduced at the undergraduate level are sustainability, participatory design, co-design, accessibility, universal design, inclusive design, design for all, role-playing, reuse, and recycle. Examples of approaches are as follows.

Sustainability

One of the main approaches tutors set via these collaborative projects was sustainability as it is closely related to a real-life context. In one example, tutors aimed to focus on local sustainability. They similarly conducted two projects with different stakeholders at different locations, in two consecutive years. As each local area has its context under a sustainable design approach, they selected a local area, one of the sites of UNESCO's World Heritage, which was outside the city. They aimed for students to study a real-life context and develop design solutions within that context. They started with theoretical knowledge about the approach such as what sustainability stands for through seminars they held at the beginning of the course. The tutor determined the main topics related to sustainability such as food supply, waste management, energy consumption, natural resources, climate change, good agriculture, wildlife, and the built environment. Tutors and students visited the site twice as a group, at the end of the first and the second month of project duration. The first visit was to familiarise themselves with the environment, meet collaborating partners, and conduct research. The students were expected to inquire about the needs and the problems of that local site. They collected data for their projects via observations and communicating with partners. After developing design solutions based on their research, they made the second visit. In this visit, students conducted experiments with the stakeholders to develop their projects in the right direction. The stakeholders were invited to the final jury presentation to evaluate students' projects. Students developed design solutions regarding local sustainability based on the characteristics of a specific context collaborating with multiple local NPOs. According to tutors, contributions of NPOs and the local community carried the design ideas of the students to an upper level.

Participatory Design & Co-design

To better adapt and teach sustainability approach, tutors in one of the universities applied participatory and co-design methods through the involvement of stakeholders in the design process. In six different projects, they collaborated with diverse non-profit organisations such as a neighbourhood association and primary schools. Four projects were conducted with the neighbourhood association with diverse aims such as empowering the neighbourhood and disabled residents. In two of these projects, primary schools were also involved. One of the important roles and contributions of the neighbourhood association was providing user involvement for participatory processes through sharing contact information of residents who wanted to attend. Both sides visited each other. During these visits, students were matched with neighbourhood residents. The first visit, in which participants came to the studio, the aim was to understand and define the need and problem area together with the participants. The students interviewed them to receive more direct feedback on the validity of problems and their impacts. After the analysis phase of the interviews, they further developed their ideas before the second visit.

In the early years, the tutors in this university implemented collective creativity practices based on receiving feedback and comments from the participants, as it was not clear how they would adapt the participatory approach. The students were asked to create scenarios and they explained the scenarios they developed. Then, the participants from the association and neighbourhood residents commented and gave feedback on these scenarios. In their recent projects, the way they approached co-design sessions was by co-creating rather than user testing of the pre-developed ideas of the students. In four of the projects, the participants were primary school students. Industrial design students and children met twice. The aim was to gather the views of children about diverse subjects such as washbasin and accessories, school door handles and accessories, saving and sharing habits. Two co-design workshops were conducted where the children took part by joining the student teams. One of them was carried out by visiting the stakeholders and the other one, by inviting participants to the studio environment. Collaboration with NPOs enables students to not only learn these new concepts, approaches, and methods but also be able to apply them in industrial design education.

Accessibility, Design for All, Role-playing

For instance, one of the projects carried out aimed to create awareness on certain concepts and approaches related to human factors and physical accessibility such as human-centred design, universal design, inclusive design, and design for all. The students were expected to design furniture considering the special need of disabled people in collaboration with a disability association. The association made a presentation about disability, the lives of disabled people, and the problems caused by products. The association brought two wheelchairs. The students tried to reach the tables, go around using wheelchairs. By role-playing students had a chance to empathise with the people they were designing for. The role-playing approach helped them to explore the user experience of people with disabilities. They realised that disabled people have difficulty in doing many things, which the students normally ignore as they seem insignificant. At another phase of the project, each student group spent a day with a disabled person. Students observed the participant for one day.

This observation also helped students to build empathy with a special user group and to understand their reality, needs, and problems. The students accessed the right information by communicating with the real users and transforming their needs and problems into design solutions. Students learned that they need to consider the relationship between the product and the user, the expertise of the partners, and the involvement of real users in the design process especially while designing for a special user group. As a result, they understood that a product design can positively affect human life.

Enabling the Future

In a tutor-driven collaboration at another university, the tutor aimed to integrate Enabling the Future Movement into undergraduate industrial design education. He offered to the collaborating partner to develop a project for them. The association was invited and expected to share information about their existing process for the research phase of the project. They gave two seminars informing students about how the existing process works, how they find a child who will use a robot hand, how they take measurements, how they make revisions according to users, and how they implant one or two widely used hand designs. After getting fundamental knowledge, students developed their designs. The role of the association was sharing know-how and the state of the art as they were experts on the topic. Through this collaboration, design students learned about the global e-NABLE Community and the concept of open-source. They also experienced designing for a special user group which was children with limb deformity, using 3D printing technologies.

NPO-driven Collaborations

In the NPO-driven model, NPO brings its intention to collaborate and initiates the collaboration by directly reaching the tutor or the department. Tutors welcome the opportunity and match it with the learning objectives and students' level. Then, they integrate this collaboration within a scope of a studio or an elective course. Six of the tutors interviewed were involved in NPO-driven collaborations and shared their experiences on this model. Yet, the motivations of NPOs for initiating and driving collaborations need to be further investigated.

In one example of NPO-driven cases, the tutor met with the mayor of a municipality, in a design competition jury organised by that municipality. During their conversation, the mayor proposed a collaboration associating design with the Movement of Cittaslow. The mayor wanted to make the district visible and liveable as it was the first Cittaslow in Turkey. The tutor turned this proposal into an educational project. A unit of the municipality made a presentation on the municipality and the slow cities. Then the third-year industrial design students developed concept products in line with the Movement of Cittaslow. The project followed a conventional design process and the representatives from the municipality did not participate in that process. Initiating the collaboration within a real context and introducing concrete design problems were valuable contributions of the municipality.

A manufacturers association wanted to run a social responsibility project on the reuse of end-of-life tyres. The aim was to extend the life cycle of obsolete tyres that had completed their lives and could no longer be used. They conveyed their intention to a public relations company where the manager was a graduate of industrial design and reached the industrial design department via this company. The tutor accepted the request and adapted the term project to the second and third-year studio course. After a presentation from the association on the importance of the issue, and the manufacturing process of the tyre, a field trip to the factory was organised. Later, the students decided on product categories themselves and developed playground equipment and public space furniture for the outdoor environment. The representatives from the NPO also attended the final jury to give feedback on projects. Tutors' motivation while adapting this collaborative project was to raise students' awareness and responsibility on the concepts of upcycle, waste management, and environmental sustainability. Students had the opportunity to work with the constraint of waste material.

In another NPO-driven case, a public institution, sent an email to the department, stating they wanted to organise a design competition of waste bins to create awareness about zero waste management. One of the tutors from the department was interested in the subject and conducted it with the second-year students in a studio course. As the subject was suitable for the level of second-graders in terms of technical details, material selection, and ergonomics. The one-month project followed a conventional product development process. Two of the representatives from the institution participated only in the final jury to make comments and evaluations. It was a professional experience for students to receive feedback from someone from the government on their projects. The process helped students to improve their communication and presentation skills and to understand the scope of their profession. Through this collaborative project, students had a brief knowledge of the zero-waste concept and they questioned waste sorting.

In another NPO-driven example, an institute of physics contacted an industrial design department with the

request for the realisation and commercialisation of science kits for children. The tutor suggested carrying the project out in an educational context. After the term started, she added to the brief as an alternative and associated the topic with an ongoing project related to open-source Maker Culture based on Do-It-Yourself Movement. The tutor invited the representatives from the institute to the studio environment to present who they are and what they do. They also mentioned the mechanisms that they wanted to develop. Then the tutor asked for the students who wanted to study the subject that the institute brought. A group of students who chose to work on this topic pursued a similar process with the other students. NPO brought the topic for the project and made a presentation on the subject, then they did not have much guidance in the process. They attended the final jury. In line with the demand of the NPO, manufacturability became one of the main criteria of the project.

Student-driven Collaborations

Student-driven type of collaboration is a common model in graduation projects. Seven of the participants interviewed were involved in student-driven collaborations and shared their experiences on this model. As this study only covers tutors' points of view, the reasons behind students' working with municipalities and other non-profit organisations need to be further explored by including the perspectives of students.

When a graduation project is the case, NPO collaborations are established either by the student or the tutor. When the students establish collaborations with NPOs for their graduation projects in the final year studio course. They individually look for and find the institution they will collaborate with during their graduation term if there is not a pool system or a list recommended by tutors that they can choose from. Students make the necessary arrangements by themselves such as finding contact persons, getting in touch with them, and agreeing on the topic they want to work on in advance. As students apply to non-profit institutions in line with their wishes, they are also expected to bring their ideas and define design briefs for their graduation projects before the semester starts.

In one of the universities which have recently founded their industrial design department with fewer students, the tutors took the responsibility of initiating collaborations with partners. The tutors who conducted the graduation project course set up the connections and decided on project topics beforehand. At the beginning of the semester, tutors asked students' topic and stakeholder preferences. Then tutors distributed the topics and matched students with collaborating partners according to students' desires. Although the project was tutor-initiated, it was the students' decision to work with non-profit organisations.

Once the collaboration is formed, it continues with interpersonal relationships between the student and the external advisor. Tutors are involved in these collaborations through written reports provided by the students. Tutors do not meet with the representatives from NPO unless there is an essential situation like a communication problem. Communication and collaboration proceed between the student and the NPO representative.

One of the departments has pre-defined criteria for graduation partners for many years such as having a facility with manufacturing capability. As the collaborator was expected to present know-how on market research and manufacturing techniques of the product to be designed, NPOs were insufficient to satisfy this technical expectation. Thus, students were not allowed to carry out graduation projects with NPOs. However, as the number of students increased, students started to have difficulty in finding institutions that meet this criterion. Moreover, according to the tutors in that university, some repeating students or students who have difficulties in going out of town, prefer to work with local governments. Since NPOs are open to accepting collaboration requests and help, students reach and arrange collaborations easily and quickly. Especially the students who want to design public space furniture work with NPOs like local governments.

On the other hand, a tutor from another university appreciated the expertise and contributions of the mentor regardless of the institution and its capabilities. The mentor provided knowledge via information and experience sharing so that the student had direct access to the knowledge in a certain field that she needed throughout the project. The expertise made a great contribution to the project and the theoretical contribution provided a very productive and instructive process for the student.

Challenges in Collaboration for Tutors

NPO collaboration in an educational context brings organizational, educational, and realisation challenges from the perspectives of tutors. Collaboration requires some organizational arrangements such as time planning, logistics, and connections with contacts. Time management is an issue due to the intense and tiring process in terms of scheduling, conducting, and coordinating the events as well as flexibility in time plan and adjustments for last-minute changes in the program. Logistics like transportation, accommodation, food arrangements for

field trips, and other financial issues should be resolved in advance. Safety is also one of the important concerns for tutors as they are responsible for ensuring the safety of students and outside of university campus is risky. Such organizational processes require a lot of personal interest, energy, and social effort in terms of communication and networking. Due to the responsibility and intense workload, these collaborations might not be preferable in education. Tutors should be very dedicated to handling these challenges.
Establishing connections with contacts from CSOs is also a necessity for collaborative projects. Communication is a major challenge that can occur at any time during a collaboration which also needs instant problem-solving abilities of stakeholders. As one of the tutors stated, collaboration requests from NPOs might have some barriers. What they want might not be achieved, the request might be ill-defined. Hence it should be well formulated at the beginning.
Educational challenges include (i) introducing and integrating new approaches and methods into design education, (ii) changing project scale from product to system, service, and experience and teaching these scales, as well as (iii) matching project scope with students' level. Since each project requires a different plan, the determination of methods and processes takes time in terms of introducing the concept and adapting it to different scales. When the projects remain on a macro scale, the students cannot associate it with design much, the projects remain more general. Students struggle with the transition from tangible product scale to more intangible system and service scale. Nevertheless, in one of the examples tutors coped with this struggle as they repeated the collaborations and project schemes and improved the plan and guidance of the design process year by year. Repeating the collaboration with the same stakeholders helps to overcome educational challenges. In repeating collaborations, the scale and scope of the next projects are changed and adapted to ease the design process for students. Positive past experiences resulted from the first collaboration and the workload (i.e. time and effort) of establishing new relationships and collaborations with partners are the main reasons for tutors to prefer sustainability of collaboration with the same partner, which is not always possible.
The last but not the least challenge is the realisability of project results which is a difficulty for every actor in a collaboration. The realisability of projects faces four obstacles; necessary budget, intellectual property rights, lack of applicability of students' projects, and time and effort required for post-production. Since these collaborative projects have benefits for society, their realisation and implementation of results are desired by all actors. However, their implementation is harder to attain. Financial issues can be covered by sponsors and writing funded projects. As these collaborations are built with interpersonal relations based on sincerity and trust, usually there is not a written agreement between the stakeholders. A clause regarding the intellectual property rights of the project should be prescribed in an agreement. It is valuable for students to work on real-life problems, but often these problems do not have simple solutions and they are much more complex than students can solve. Therefore, the results expected from a university student might not be viable. The number of stakeholders can be increased and diversified, project durations can be extended, and topics can carefully be chosen to cope with this challenge. Even though student projects are feasible, the commitment of actors is another struggle. Many of these collaborative projects do not end within the pre-specified period as they need post-production for realisation. Completing them are not so easy because of the time and effort expected from the partners, although they are willing to continue.

Discussion and Conclusions

In line with the World Design Organization's definition of industrial design, collaborating with NPOs in undergraduate industrial design education has many opportunities: (i) providing a better quality of life through expanding the boundaries of industrial design from products to systems and services, thus encouraging students to think on macro-level to cover widest solution areas, (ii) co-creating design solutions with trans-disciplinary nature of the profession, (iii) valuing the social and environmental spheres.
NPO collaborations help to implement concepts in undergraduate industrial design education such as design for sustainability and inclusive design with the expertise of an NPO representing a community. Particularly for addressing sustainability approaches, tutors expanded the scopes and scales of projects from individual use products to systems on larger scales. Students suggested system-oriented scenarios, composed of a product family, instead of products. It is important for students to experience the design process for different scales such as developing both product and system-oriented design solutions together.
Dealing with complex real-world issues requires more than one area of expertise. Working in teams and collaborating with diverse stakeholders and other experts help students to improve their team working and collaboration skills while developing more detailed and comprehensive design solutions. Involving real users especially special groups in these collaborations provides an opportunity to apply design methods such as participatory design and co-design which is difficult for the educational institution on its own. Having accessed

to special user groups such as disabled people, children, and the elderly, students understand their experiences with direct contact and exchanging ideas. Through the involvement of different partners, students learn to work for and with them and develop together with them and gain strong communication and presentation skills.

Focusing on the real needs of real users allows all stakeholders to leave aside the concerns of making a profit and concentrate on social and environmental aspects of design. As universities are not disconnected from society, they can have a strong influence on society. As design is a practice that has a huge impact on the society and environment, tutors' personal interest in social and environmental issues also triggers their motivation to collaborate with NPOs. For this reason, through these collaborative projects, tutors want students to be aware of the social and environmental responsibilities, and to think and question the social and environmental impacts of their designs and learn to take this responsibility.

The parties need to agree on more structured and systematic processes for collaboration by negotiating on terms and conditions, in which roles, responsibilities, and expectations of each actor are discussed and defined. An extensive and well-prepared protocol could help to overcome the challenges in these collaborations. Yet, the frame of this protocol should be further studied.

The sustainability of collaboration, which is a result of win-win situations, depends on personal motivations, willingness, and skills of actors such as time management, communication, social relations, and effort. Achieving sustainability of collaboration results in structured and improved collaboration schemes and processes.

The realisation of solutions makes not only the collaboration process effective but also the results. For the realisation of projects which provide solutions for addressing real-world problems, the motivations of the actors will not be sufficient alone. Intellectual property issues and lack of applicability of student projects need to be solved in the planning phase of collaboration. As publishing the results will increase the visibility, it may also raise awareness for fundraising and encourage other parties such as manufacturers to get involved and invest. Along with the tutors' perspective towards collaborations, motivations of other actors, NPOs and students, for initiating and driving collaborations need to be further investigated.

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