Chapter 65
CREATED METHOD: Pedagogical Approach for Diversity in Creative Design Process

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Abstract The principal objective of this paper is to demonstrate the capability with creativity and innovation to develop ideas for technology driven students (Simonton in creativity in science, Harvard University Press (2008) [12]). The new teaching Created Collab Model: (CCM), examine with undergraduate also graduate design and engineering students at various aspects with step-by-step progressive process. "College education must help students to develop those competences in collaborative environments and better address these needs. Developing students' knowledge and skills in contextualized engineering environments [14], practicing teamwork, leadership, decision making, experimental work, and critical thinking are some of the important aspects addressed in this track." (Viegas et al. in 21st century challenges in engineering and technological learning (2017) [13]). The paper describes 21st Design Education as a creative method focused on innovation for society and industry. One that combines mass wisdom and talents in multidisciplinary fields through advanced digital technology [11]. A virtual studio was proposed that contains number of teams exploring a topic, studying, and designing innovative products. Each team is comprised of different areas of knowledge: product design, mechanics, graphic design, architecture, art, animation, etc. A joint online project "Innovation in Project Design," using an On/Off synergistic studio was practiced during one semester (Avital and Mazor in circling the square, creativity in engineering design, STANFORD, US (2014) [5]). Multidisciplinary teams (Israel, India, Australia, and Japan) were challenged in projects of social importance. The teaching method relates to a synchronous virtual environment, where the teams interact and learn at the same time, and also asynchronous, where they plan and respond at different times. The purpose of the joint course is to learn and work in global teams, as well as to create and design innovative projects within the limitations and barriers of geography, time

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zones, cultural and demographic backgrounds, in team of diverse learning disciplines. This qualitative field research, along recent years, present lot of team design processes and final projects.

65.1 Introduction

The world is growing in terms of ideas and technology so fast in this twenty-first century globally, in businesses and social life. Upcoming industry is growing with multidisciplinary approach by using cross-cultural and cross-functional solutions in R&D teams globally [6, 11]. In a scenario where demand of the raw materials, design, and manufacturing is growing, companies are playing strategically to solve the problems of cost cutting, quality with profit and logistics simultaneously. When the global distribution strategy is planned and designed in a company, the profit projections in terms of price, sales and profit margins are very important factors to consider. Here, design plays a huge role to fill the gap [8].

The main aim of the educational institutions in varied areas like various divisions of engineering, design, art and science is to teach and train young talented minds on how applied science, technology and hands-on skills work together creatively with each other in critical conditions during the projects [10]. Also, how to be prepared when you work in teams, who are working in cross-cultural projects so, that it can function effectively to produce innovative and unexpected results. Online education represents a significant paradigm shift in the history of higher education [7], but not in integrative engineering, science and design together [12].

65.2 Created Collab Model

A new method is been designed called "Created Collab Model" (CCM) to bridge the gap between cross-campus collaborations in a Laboratory and studio-based scenario. The method is based on the on/offline approach in which we focus upon fostering interaction and learning via online platform between engineering and design with hands-on training in various projects [5]. When we talk about engineering and design in various countries, the nature and process of work differs drastically in terms of inventions, techniques and technology. The conditions in different countries differ from culture to work ethics point of view. So, this method has been designed to help the students to have an interaction with cross-cultural and cross-functional approach via interdisciplinary signification. CCM moves a new educational shift, which will help the student to have an instructor-centric approach to student's team-centric approach. Also, we have involved industry to create a knowledge hub between different countries students, where instructors and students take up a new interactive approach to understand each other's research constraints in their own respective countries. With this new roles have emerged, which students have to handle in their

respective teams, like dealing with the project coordinator of both the country teams, dealing with the company problem statement, etc.

CCM generates emphasis on innovative and creative concepts from mixed interaction among various students' talent, their skillsets and knowledge. This method is an extension of E-studio approach [1]. It follows peer-to-peer approach with mix of design thinking in two phases: The teams include six students, each from varied backgrounds and mix from campus. We have set up a virtual team studio with internal and external design processes and cross-campus approach as well. Pedagogically, based on asynchronous and synchronous learning, a team catered teaching leading to a project oriented method, which involves online learning and de-coding of the project brief instead of constraints like language, place, distance, etc.,

Such as one team location was in SCE Israel and another located in other corner of the word at IIT Guwahati in India. The sessions were the part of semester in which time was the biggest constraint. Participation of students from varied sections from Bachelors and Masters as well as research scholars from mechanical and design backgrounds was involved in this mix media Created Collab approach. Teaching with basic principles, scientific innovations, discoveries, and methods has been shaped the upcoming generations and incorporating them into the course structure and bringing out insights got the main emphasis [2–4]. CCM model follows pedagogical approach to advance innovation in design that enhances thinking approach, creative thinking within individuals among group members enhancing their diverse skillsets, talents and personal/cultural background. This course challenges students on several levels: How to create team framework? How to use the diverse talents of team members? How to design together? Different professional fields, geographical distance, wide time zone, syllabus gap and academic scheduling, gap of knowledge, skills and talents. This qualitative field research, along recent five years, presents a lot of team design processes and final projects.

65.3 Methodology

Our research objective is to find out a way to make classroom teaching much more collaborative, interactive, and knowledge driven where concepts, principles, processes, and hands-on activities with fact finding can be encouraged to come up with creative and implementable solutions for the society. We have conducted nine such sessions over the period of five years starting from the August month of 2015 till the beginning of 2020 with multidisciplinary teams from different universities.

(a) Course content-related collaborative lectures were organized and also invited online sessions that were conducted by National and International faculties.
(b) Further students were divided into groups according to their expertise. For the same, detailed document with individual details was shared with everyone.
(c) Individual presenters were invited from various industries like animation, product design, design thinking, gaming, etc., to share their knowledge.

(d) Initial activity demonstration was given by the individual instructors to the students including sharing of the material, digital notes and supporting material and references.
(e) Student teams were made to interact with each other and problem statement were shared. Further, individual teams did redesigning of the brief.

For the same in each course, around eight multidisciplinary groups were made 5–8 students from different disciplines with visual communication designer, mechanical engineer, animator, field researcher, etc., were divided and progress were shared by individual team members via software's like slack and Trello. For the internal communication between the student groups, applications like WhatsApp, Gmail, Teams, Skype, etc., were used.

65.4 Model Structure

CCM is based on team-centric approach, which breaks the barrier of traditional classroom practice to an open studio creative space, where students who are the next-generation thinkers can crunch on their ideas and concepts. In Fig. 65.2, The model brings the interaction with a larger group and users in their respective countries and allows them to organize their interaction with online discursions, their team views or post a reply in a face-to-face forum of messages with the help of online chats, mails, etc. Also, during the discursions they can upload the videos, animations, and ideas in form of sticky notes on the discursion desk. This approach was followed supported with different forms of communication like texting, chat, voice messages, video conferencing, blogs, wikis, etc., for sharing their ideas and discursions (Fig. 65.1).

In Fig. 65.3, one can see that Team A from Israel campus and Team B from Indian campus has started working on the common problem statement and through interaction started by the facilitator from both the campuses, who were mentoring and guiding the students on how to come up with ideas and concepts based on innovation in design and engineering instead of barriers and time differences. Innovation in design thinking is based on the collective knowledge and thinking skills, with combination of ideas and flexibility of thoughts encouraging student teams to work in a collective way. In Fig. 65.3a, one can see the classification of various students collecting major data from their teams and in Fig. 65.3b one can see the individual country mentors are guiding multiple project leaders with their teams.

One of the important aspects of team design is the ability to self-criticize and evaluate as also mentioned in Fig. 65.3, the quality of the design process, the passion for quality, and the innovation phase of the final output. In light of this, we asked each team leader to score for each member of his team and himself for a ranging from 50 to 100. This request gave the team leader an attempt to a new outlook perspective at team design as a personal process of each member, of the facilitator vis-à-vis the team leaders; to a large extent, we can state that the personal and immediate familiarity of the team leader improve deep quality of the project guidance.

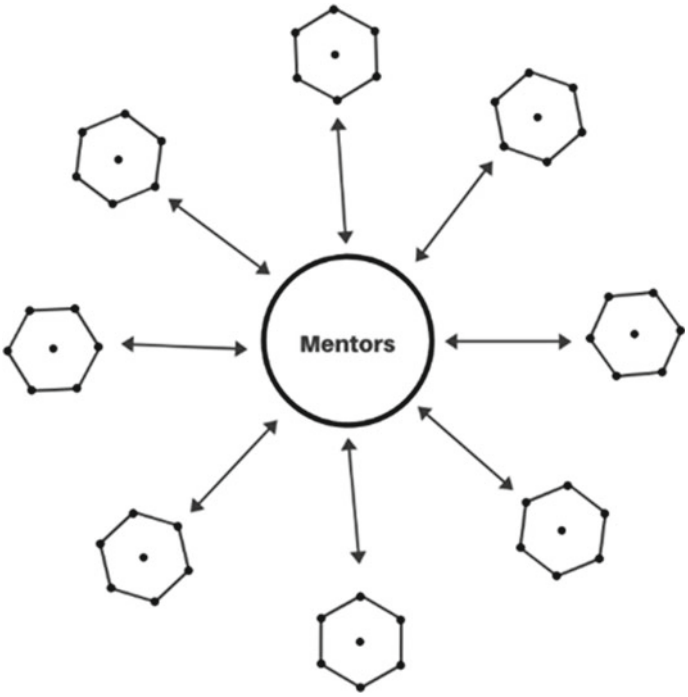

Fig. 65.1 CCM case study I: Tangible team (Figure by author)

65.4.1 Structure of Each Team

Each team has two facilitators, who maintain continuous interaction throughout the CCM project. The place of the facilitators in this project is very special. They bring two voices, two opinions, and two areas of expertise to the team. The team members are interacted by the guidance of two facilitators, but also really challenged by their differences in design approach to the project and their say and opinion. But, this is the CCM tipping point: in this interaction, the teams learns to develop independent and flexible thinking, and to deal with two completely different facilitators; their professional background is different, their expectations from the project outcomes are not necessarily uniform, they teach different fields in different languages and in a different academic environment, including the duration of a the course. One teaches a continuous semester course every week, and the other teaches the entire course for two full weeks. The schedule is so different besides Skype troubleshooting but this is a great challenge that joins a host of other gaps that include different levels of English, accent, professional terminology, and even methods for planning a project and setting a presentation. This chaos of obstacles is an important part of CCM project because it is a unique design training teaching students to work in different global frameworks stress of time and locations and also look for ways to overcome

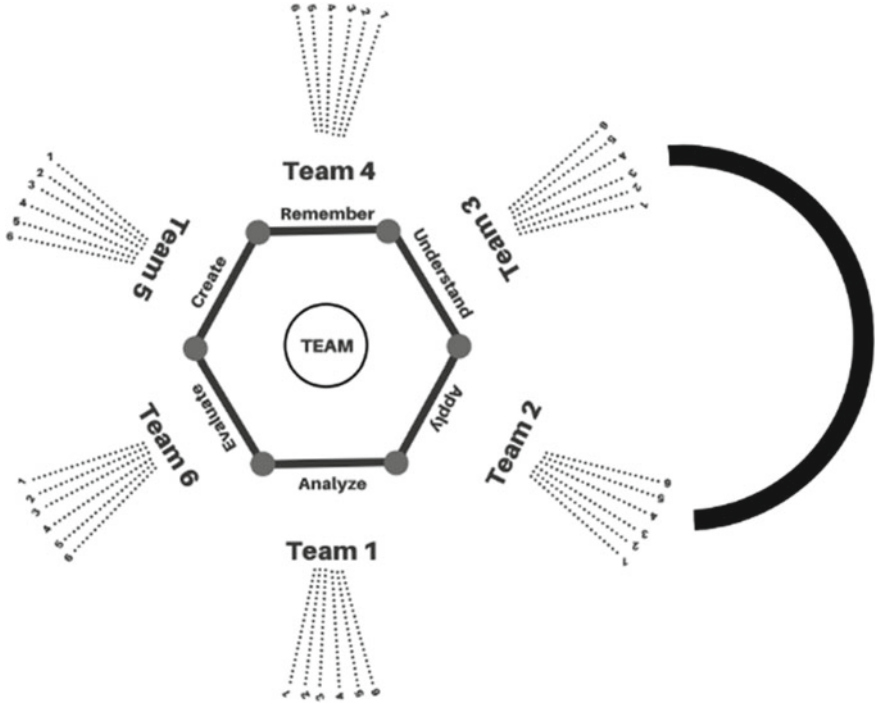

Fig. 65.2 CCM case study II: COVID-19 teamwork (Figure by author)

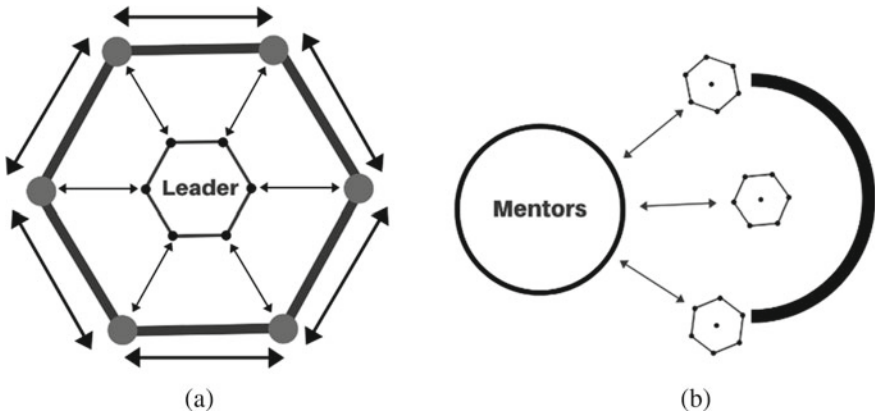

Fig. 65.3 CCM case study II: **a** self-criticize and **b** evaluate (Figure by author)

the obstacles and meet a set schedule. The facilitators ensure that there will be time-sensitive work and strict requirements to train each team leader in the division of research tasks, ideation and conception, product rendering and prototypes, in strict observance of the schedule, and engineering and design quality.

Teamwork in the product design has several advantages that affect the quality of the final outcome. The synergetic experience teaches each student to interact with others' knowledge and talents, to get and to give in an integration process. An initial acquaintance is created and personal friendship develops between the members of the team from one country to another, then professional acquaintance, personal abilities and talents. At this crucial point, they begin to plan and design together the project. The team leader divides tasks, and they split to their own challenge. This initial stage in CCM is critical and is the main productive process during the project. The disadvantage of large work teams is the different output of students. There are those who are lazy and work little or slowly, and there are those who are challenged to the subject and goals of the project, are excited and work day and night. There are interesting insights from the facilitators; they recognize the diverse talents of the students, as well as those who can lead a design team. Also, because they are involving in all group chats of different team discussions, they learn better how students try to bridge distance problems.

65.5 Case Study I: Scoodent Project and Game Design Project

There were two projects proposed in the year 2016–2017 covering two semesters. First project is to design a campus scooter for students and second project is to create a game for visually impaired kids between the age group of 8–12 years. The project was facilitated by course instructor in two different countries in cross-campus classrooms by encouraging team discursions in two stages: firstly in order to introduce the session and motivating the student's introduction session is been organized also to introduce the new teams with each other. Secondly session on idea generation and design thinking in relation to the project development was introduced. Encouragement is the integral motivation factor kept which leads to innovation. Sessions were introduced on how to define a problem, use contextual enquiry etc. discursions on how to ideate, prototype, and present the ideas is been discussed. In the end, the instructor describes the main challenge of combining scientific thinking of engineering and creative thinking of designers to come out with creative ideas for the following projects. Other parameters were also kept in mind like climatic conditions, time constraints, space for both the projects also target audience (Image 65.1).

Gamification has been introduced, with the help of which students have applied and learnt game mechanics and techniques to bring engagement factor for the users. Later aim and objectives of the project were detailed out to both the teams like to build

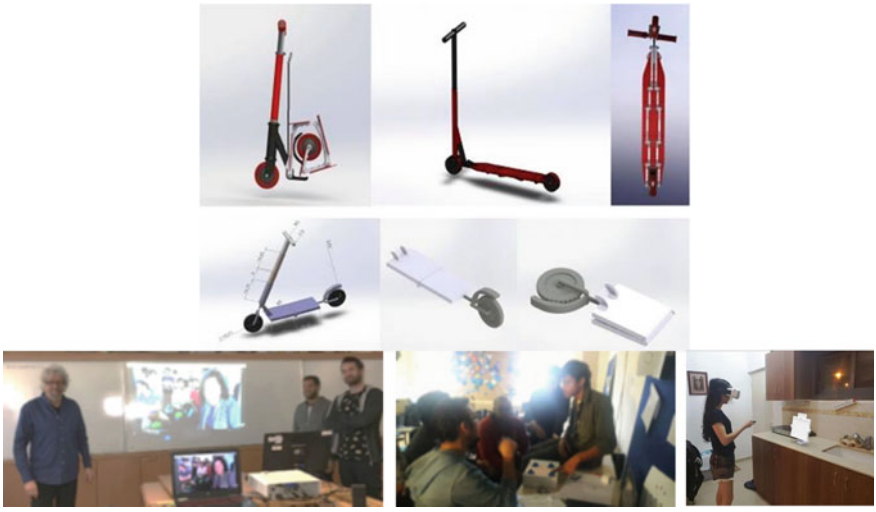

Image 65.1 Intercountry teams interaction (Images by author)

a game that can be enjoyed by blind or visually impaired as well as sighted players. You can use any material, sound, touch, and other senses to enhance your ideas to create something educational [2]. Use the concepts of science, engineering, design, and technology. There are countless angles one can use for possible exploration, like what happens when you see dark everywhere and you start-experiencing things around you with your other senses? Uses of empathy as a tool for creating the experience for visually challenged were incorporated (Image 65.2).

It was also mentioned that the game design project should have the young, creative look and feel. Using design thinking as a tool to create interesting and innovative idea generation tool in the systematic search sources for interesting way to tell about concepts/stories was encouraged. We encouraged **internal sources**, which refer to the team's talents and skills. **External sources** refer to sources outside such as customers, competitors, and suppliers, and **design sources** refer to product biography of all kinds of games. The importance was given to use of various materials, local techniques, local crafts and use of skills sets, which the team is good at. The teams have continuously been in touch with their teams in both the countries, setting timetable and setting the project process, sharing knowledge and skills, preparing a flow process of project steps, and presenting in a form of presentation. For the communication, WhatsApp, Skype, Gmail, etc., were used. Leader for every team was taking care about the timetable of the project and plan of how to overcome the barrier of culture, actions, situations, decisions, etc., within a team.

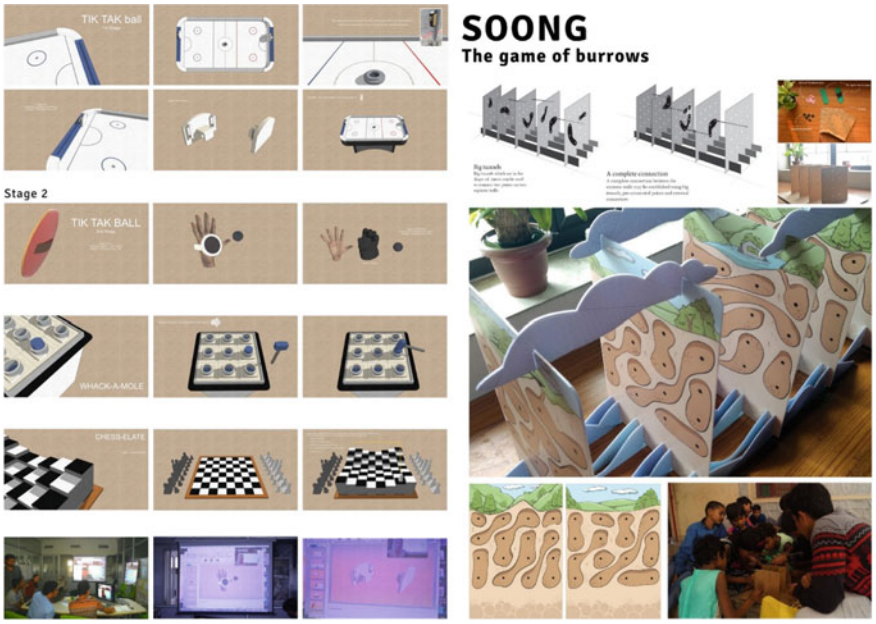

Image 65.2 Developing games (Images by author)

65.5.1 Case Study II: (Design Thinking and Creativity)

In 2015, collaborative sessions on design thinking and creativity have been done with teams from India, Israel, and Australia, in which common session activities were designed and conducted (Image 65.3).

Group of students has started with the sketching and doodling exercises by taking inspiration from nature. Further an invited session on "importance of line of action" in sketching was conducted. On the basis of it, various visualizations were done. Similarly teams were asked to discuss about their output and develop a narrative on the same. Further in the second part creation of 2D to 3D exercises was developed like the creation of character in 3D form [9]. The purpose of this creativity exchange exercise was to develop understanding about various aspects of 2D to 3D transformation and understanding aspects of color, line, motion, etc [4].

65.5.2 Case Study IV: (Redesigning Social Robots and Water Purifier)

In an E-studio project on nurturing creativity and innovation in students, design and development of a socially active robot with its instructional manual was done with

Image 65.3 Hands-on activity sessions with teams (Images by author)

the cross-country teams. They have to design a robot, which can help students in developing creative tasks. Total 35 students participated in semester long session. Teams have used the process of been divided and many sessions were conducted to come up with the final output (Images 65.4 and 65.5).

In terms of design thinking that strives for innovation, there were two distinct problems that challenged the facilitators. The first, some students limit their imagination to create innovative output of their professional field. For example, mechanical engineering students bought on mechanical ideas, without using other engineering fields such as chemistry, programming, and the like. An important step within the guideline was to encourage them to think outside of their disciplinary box and to create advanced and innovative ideas even if they themselves did not know their design stage. The goal is to release cables of the acquired knowledge field for the sake of developing curiosity and breaking student conventions, at the idea stage, in order to achieve innovation. The second problem, independent decision-making by student staff in the field of ideas, slows down the pace of the project. The team is hesitant to choose between the different alternatives. The diverse background of the team members creates a problem that needs to be solved. The facilitators, at this stage, try very hard not to interfere or help, because the dynamics within team will lead to authenticity and thought independence. As a general rule, the facilitators in these two stages are navigable in general and avoid introducing solutions. In contrast,

Image 65.4 Social robots developed by student teams

internal discursion is encouraged in each team, allowing all team members to get involved and bring innovative ideas out of their world and professional background.

65.6 Evaluations and Feedback by Individuals

A survey was conducted to analyze the effectiveness of the "Created Collab Model" among 30 students out of which 26 responses were received. When asked about the most interesting phase of the whole project (as example in game design project) some of them mentioned that they have found the whole process deeply engaging and learned about varied methods used in different countries. Collaborative lectures helped them in redesigning of the brief. Creating ideas together by understanding the universal feasibility is quite a learning experience for students. When asked about the least interesting part, some of them mentioned about rescheduling meeting was quite

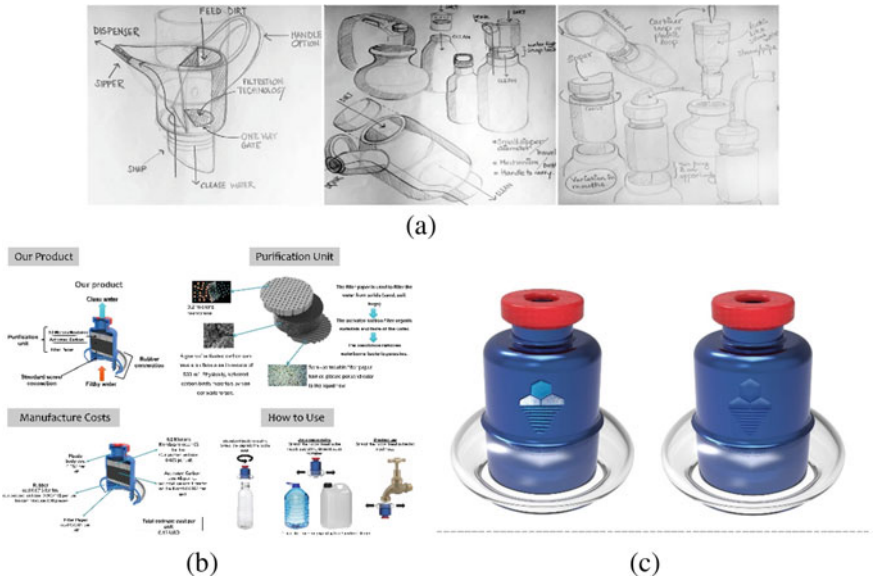

Image 65.5 Project on water purifier

tiresome for them. When asked about most satisfying part of the whole process, some of them mentioned that they have found similarities in their ideas and that helped them in building the compatibility with other team members internationally and that helped them in better team building and interaction. 60% of students have found that they have communicated well by the use of technology and found engagement in the discursions. Respondents also mentioned that processes like design thinking and other experience have helped them empathizing well with the user and the approach helped them in the understanding of the user group. When asked about whether the process of research has helped them understand in developing the idea, some of them mentioned that it has helped them in understanding of user behavior, lifestyle, and their needs in step-by-step manner. When asked about how well closer interaction between the collaborating institutions assist students to develop design skills, on that 80% of the respondents were highly satisfied and 20% of them said that because of time constraints, it was difficult for them to manage the schedule. Overall "Created Collab Method" was found suitable to make classroom teaching more collaborative, interactive, and knowledge driven with incorporation of many hands-on activities, which encouraged student teams to come up with more convincing solutions.

65.7 Conclusion

(a) We have come to know that an important part of design education is to challenge the students in social projects, for the sake of the individual and the general, which is if interest to them.
(b) A meeting of students from a multidisciplinary background with rapid technological innovations presents a rare opportunity for students to experiment deeply with creativity.
(c) Teamwork, practical and virtual, develops the student's ability to utilize one another's talents and, at the same time, contributes to the team's abilities.
(d) We have come to the conclusion that facilitators are not lecturers, but mentors whole role is to generate positive energy in each team to produce design innovation.
(e) We found that a team leader has the ability to be highly motivated to excel in competition with other teams.
(f) We found that the many challenges facing students (geography, culture, communication, schedule, etc.) set a high threshold that required a different approach in the project's process.
(g) The facilitators were involved in each team chatting (through various tools like WhatsApp, Trello, etc.), monitoring the internal dynamics of the team. They focus on each team leader on the small details level.
(h) Collaboration between varied disciplines (engineering, design, graphics, animation, architecture, and art) yields lateral thinking that comes from working on a collaborative project, and generates many innovative opportunities out of the box. We have found that team list is important and can predict the team's success in meeting the many challenges this CCM poses to students.

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