

THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI 625015**Best Practice 1: Implementation of Design Thinking Course**

The major objective of any engineering program is to produce graduating engineers with ability to conceive-design-implement-operate complex value-added engineering systems in a modern team-based environment. In the view of students' engagement in solving challenging and real-world problems, the Engineering Design course was introduced in our earlier curriculum. With use of design principles, students developed a prototype addressing a specified theme area like smart city. It was observed that students were enthusiastic and interested in developing innovative ideas. Besides, feedback was also obtained from the course handling faculty members and they expressed their need for training in handling project-based learning courses. As part of institutional capacity building, twenty faculty members were undergone a training programme on the Design Thinking course with the human-centered design approach offered by Purdue University in collaboration with Indo-Universal Collaboration for Engineering Education (IUCEE). In order to improve the students' involvement in community-based projects and addressing technical, personal and interpersonal skills, the previous Engineering Design course was modified as Design Thinking course. This course is a customized version of the Engineering Projects in Community Services (EPICS) design process by adopting the first three of its phases namely problem identification, specification development and conceptual design phases.

The Design Thinking course was first offered to 880 undergraduate students belong to civil, mechanical, electrical and electronics, electronics and communication, computer science and engineering, information technology and mechatronics programmes in the academic year 2019-20. Significant outcome of the design thinking course includes 164 conceptual prototypes of real-world location-specific community problems. A study was conducted to analyze the students' engagement in this course and in addressing community-based projects influences their perceptions on learning experiences and professional skills of 21st century learning skills (creativity, critical thinking, collaboration, and communication). An institutional survey with a 4-point Likert scale has been conducted to determine the effectiveness of the course. Students' learning experiences in the Design Thinking process, team experience, professional communication and assessment were performance measures of this online survey. Satisfaction index of the students is improved mainly because of experiential learning. Use of the rubrics for periodic reviews served as an effective instrument for assessing personal and interpersonal skills of the students. Opportunities provided for promoting 21st-century skills namely creativity, critical thinking, collaboration and communication have motivated the students to take up the prototypes to next level of its implementation. Many of our students have extended their projects of design thinking and exhibited their implementations in national level contest like Smart India Hackathon and IUCEE-EPICS Design contest and received good recognition and rewards. The training programs on Design Thinking have enriched the faculty competence in mentoring the students with a human-centered approach to solve real community problems. The outcome of this training resulted in faculty awards for their posters in Design Thinking training

programme. The course coordinator has been rewarded with IUCEE- Transformational award for the year 2019 under the category of Leadership in Community Project-Based Learning (CPBL). Based on the feedback from faculty and students and as a part of continual improvement, few refinements in the pedagogy of Design Thinking course are in progress. Based on the experience gained in its initial attempt and the feedback from the faculty & students, the implementation process for managing an interdisciplinary team is under development.

Best Practice 2: In-house training workshops for enhancing faculty competence in CDIO Implementation

The **CDIO INITIATIVE** is an innovative educational framework that has been followed in many world-class educational institutions in USA, Europe and Asian countries for producing the next generation of engineers. It provides students with an education in the context of Conceiving — Designing — Implementing — Operating (**CDIO**) real-world systems and products. Thiagarajar College of Engineering (TCE), Madurai is one among those institutions following the CDIO framework for all undergraduate engineering programmes since the academic year 2018-19. In our institute, a sequence of training programs has been conducted initially by the internal CDIO experts for selective faculty members from each department and the trained faculty members have been involved in knowledge transfer in the respective departments. There has been introduction of new courses pertaining to CDIO including Engineering exploration, design thinking, system thinking and lateral thinking in UG engineering programs. Though the new courses like engineering design has been well received by the students, it has been felt that CDIO initiatives needs intensive workshops to all the faculty members focusing design of CDIO curriculum, acquisition and practice of CDIO skills to enhance the faculty competence in CDIO. Hence, a series of CDIO training workshops has been planned with all the three elements of any FDP: Outcome based content, assessment activities to measure outcomes and analysis of feedback to find insights. The two major outcomes of the workshop are: At the end of the workshop the participants will be able 1) To design theory course with suitable content, delivery methods and assessment in CDIO curriculum 2) To incorporate necessary changes to be made in laboratory courses with respect to CDIO framework. Workshops have been conducted in three batches with the topic “Design of CDIO curriculum” in online mode for all the faculty members (n=205) in consecutive weeks. Two quizzes have been conducted and feedback has been collected at the end of the workshop for each batch. The outcomes of these workshops were measured through the Higher Order Thinking Skills (HOTS) exhibited in the assessment activities and feedback. It has been observed that the training workshop satisfies the expectations of the participants with a Satisfaction Index of 0.924. It has been found from the results of assessments that more pedagogic innovations need to be introduced in these workshops to make them excel in higher level cognitive tasks. There are few recommendations drawn from the feedback given from the participants to prepare for the next level of programs needed to improve their expertise in CDIO framework. The transformation of teachers with this training workshop in designing CDIO curriculum shall be realized in the next academic year 2021-22 as there shall be design of new courses based on CDIO initiatives. A study shall be conducted during the time to measure the outcome of this workshop in terms of student performance in CDIO courses. In future, there may be specific need-based programs based on the experience and expertise of teachers in terms of CDIO implementation. This research study paves way for looking into the organization of FDPs in the educational institutions as need based specific training workshops.