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Making Engineers Future-Ready by Building Design Thinking Skills - a Blended Learning Approach

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Abstract:

At Mahindra Technical Academy we aim to create future-ready engineers by training them on design thinking (DT). The organizational expectation from these engineers is that they challenge conventional thinking and innovatively use all our resources to drive positive change in the lives of our stakeholders and communities across the world, to enable them to RISE. Human-centred design thinking (DT) is a problem-solving approach that focuses on users and their emotional needs while experiencing products and services. It is a structured process to find solutions to multifaceted human problems. The uniqueness of the design thinking process is that it helps people to identify and solve problems that are unstructured and have no historical references. It helps dissect problems that are complex and frame/reframe areas that require solutions.

To train a large community of engineers (~ 3000) in design thinking in a very short time (1 year) we need a training program that is scalable, customisable and cost effective. We explored a blended learning approach to realise this objective by leveraging:

a) Design thinking on-line course from IIT Madras on NPTEL
b) A series of four DT Sprints conducted by a practicing DT expert, and
c) Mini projects carried out by small teams under the guidance of DT experts.

In this paper, we share our key learnings from our blended learning, design thinking pilot project. We will DT projects ranging from last mile connectivity to smart farm vehicles, to illustrate the uniqueness of our blended approach. We started our journey by applying design principles to design products and now we see a greater potential to re-design the organisational mindset and culture through collaborative ideation and prototype building. Most recently, we have built a DT lab to provide a conducive space for our engineers to practise DT.

Keywords: Design Thinking, Disruption, User-centric Innovation, Product Development, Automotive, Farm Sector.

Introduction

Many organisations are seeking to become more Innovative, Agile and Creative. A Design Thinking workshop is a practical way to get started with understanding how Innovation, Agility and Creativity can be fostered within even the most traditional of organisations.

A Design Thinking Workshop allows an organisation to confront a single problem as a group. For the duration of the workshop traditional roles and hierarchies are set aside. Everyone has the common goal of working collaboratively on a single idea. At the end of the day groups present an idea back to their peers.

Creativity can come from anywhere. It could be the head of department who has a brilliant idea, but equally transformative ideas have come from executives, freshers and Interns. A well-facilitated Design Thinking workshop levels the playing field and allows ideas to be assessed on their own merit. Part of the power of a Design Thinking Workshop is to allow an organisation to be exposed to this way of working.

Designing the Blended Training

Conventionally in Corporates two type of training methodologies are most common.

a) Workshop mode or Classroom sessions

b) Online training modules or e-modules

The workshop mode or classroom sessions require a subject matter expert to explain the concepts in detail to the learners. This is considered as a very effective training methodology since the learners can interact with the subject matter expert and can get their doubts clarified. Workshop mode also helps in understanding the concepts practically which helps learners to gain confidence in the new concepts they learnt. The downside of this methodology however is that it requires the learners to leave their ongoing project and dedicate time for training. The cost of arranging such training is also high since the trainers are required to spend considerable amount of time to explain the concepts theoretically as well as demonstrating them practically.

The other form of training and the one that is very popular nowadays among corporates is online training or e-modules. The popularity of online modules lies in the fact that they are literally accessible anytime and from anywhere. This helps the employees to continue with their current projects while getting trained in future competences. But statistics shows that only 5% of learners who enroll for online training actually complete the modules. Research points out that e-modules fail to seize learners' attention for long. Learners often point out that modules are less attractive mostly since they fail to bring in clarity required in understanding new concepts. Most e-modules do not require the learner to take any action and thereby learn through application. These leads to losing of interest in the content.

Mahindra Research Valley follows a framework referred to as CDIO (acronym of conceiving, designing, implementing, operating), to train their engineers. This Framework ensures that new concepts are systematically introduced to engineers and that learners should get a practical exposure to the concepts once they have understood the basics. Designing a Design Thinking training in Mahindra Research Valley meant following the CDIO framework while ensuring the training is precise, engaging and effective for engineers who are looking to pick up the ability to design based on the rational, emotional and meaningful needs of their users. The best way to design such a training is to apply the process of Design Thinking itself. With the experience of designing multiple trainings on various subject matters and for a varied group of Engineers, Mahindra Technical Academy could easily empathize with the learners and analyze their true needs. A unique Framework was developed namely the 3Es - Education, Exposure and Experience.

In the Education phase learners are introduced to the new concepts. At this stage a learner is looking to get hang of a whole new idea and thus may need to spend considerable amount of time to understand each aspect of this new idea. The ideal training methodology at this stage should be online training or e-modules - it allows the learner to go back and forth and watch the videos multiple times to get familiarized with the new concept.

In the Exposure phase the learner should get acquainted to situations where they see a direct application of the theoretical knowledge imparted during the Education phase. The methodology may include sharing examples where someone has implemented the new concept and demonstrated its successful application.

After the Exposure phase the training framework should move the learners to the Experience phase. The objective of this phase is to handhold the learners in applying the concepts in a real project. This will help the learners to gain the confidence required retain and apply the knowledge.

The Design Thinking training at Mahindra Research Valley was developed based on this 3E coaching framework. Engineers are enrolled in an online design thinking course where they get the basic understanding of the Design Thinking methodology. The online course spreads across 4 weeks followed by an online exam. This phase of training is considered as the Education phase of the course. A two-day workshop then exposes the engineers to the application world of Design Thinking.

To ensure uniformity in the whole curriculum, the online e-module coach facilitates the two-day workshop. In this case Dr. Balachandar Ramadurai who teaches Design thinking on Swayam platform (in collaboration with NPTEL and IIT Madras) facilitated the workshop. The learners get their doubts clarified in the workshop and understand the concepts in detail during the workshop. The workshop is intended in such a way that learners get complete understanding of the four stages of Design Thinking namely Empathize, Analyze, Solve and Test. During the Education phase itself the learners have already understood the basics of these four stages - it is in the workshop that they get to see the application of the methodology.

The first day of the two-day workshop focuses on exposing learners to the Empathize and Analyze stages of Design Thinking. Learners are divided in groups of 5 each. Each group gets to work on a popular problem which are very common as social media topics. The groups then enact the problem statement through the eyes of the user. Once all the groups are done with the enactment, a different group is allotted to solve the problem highlighted by the other

group. Thus, each group gets one problem to solve as a designer and one problem to own as a user. As a designer, the groups empathize with the corresponding user team and come up with solutions to the problems highlighted by the team. At the end of the second day of the workshop that takes the learners through the final two stages of Design Thinking, Solve and Test, all the teams get to validate their solutions from the corresponding user teams. By the end of the two days the learners gain immense confidence in the whole process of applying Design Thinking in a practical problem.

The final phase of the 3E framework starts after this two-day workshop. The participant teams are given real life problem statements from within the organisation, to solve using Design Thinking methodology. The team get approximately 60 days' time to work on their corresponding projects. During these 60 days the teams go on field visits to empathize with their users, analyze the collected insights, formulate problem statements through root cause analysis, apply idea generation techniques to come up with ideas, make quick and dirty prototypes and finally present their solutions to the stakeholders for validation.

This full methodology of mixing online training module, workshop coaching and field visits for the three phases of curriculum viz. Education, Exposure and Experience is termed as Blended Training approach at Mahindra Research Valley.

Sayantan & Shankar [1], in their work have recommended an almost equal distribution of time to all the sections in the MOOC as well as the Face to face (F-to-F). Stuti and Shankar [2] discussed about the multiple mode of delivery through MOOCS, Industry experts and inhouse content can be used by product development professionals to give the overall exposure to their employees and also discussed about blended learning a by-product of the technological revolution– can help learners learn by creating an impact at various stages of the learning lifecycle.

Application

The impact of a Design Thinking training at a product development organisation should be measured by the number of innovative ideas that are developed as an outcome of the process. This section describes novel solutions that engineers at Mahindra Research Valley could come up with to five real life problem statements given to them. This also describes the process they followed in developing these ideas.

Project 1 – Same vehicle two purpose

Most customers of a personal vehicle use their cars in two ways:

a) Weekdays – Alone, to commute between office and home

b) Weekends – With family, to go out for fun

The requirements for both these uses are very different. The assumption is – the user has to compromise on few aspects since it is impossible for one design to fulfill needs of both type of uses. The team's objective was to challenge the assumption and come up with certain features (design, performance) for a personal vehicle that can easily meet the needs of both type of uses.

The team interviewed users with personal vehicle and those who prefer using shared mobility during weekdays for office transport. They created customer journey map for the users, applied root cause analysis technique and came up with multiple quick and dirty prototypes to explain their solutions which are unique and business focused

Project 2 – Shared ride

OLA Share or UBER Pool have not been that popular over various privacy concerns. The non-pool OLA and UBER rides also fail to provide customers the WOW feel of 'owned vehicle' due to customization, connectivity and various other issues. The team's objective was to come up with certain features (design, performance) in a vehicle designed for shared mobility that meets the unmet needs of all the stakeholders (the owner, the driver, the rider).

The team interviewed users who prefer shared mobility over personal vehicle. They applied insighting techniques to interact with the users and understand from them the various troubles the face during a shared ride. The team also interviewed drivers of various shared mobility platforms to understand difficulties that they face. The solution varied from new technologies two new business model that Mahindra as an OEM may try to implement.

Project 3 – Smart Farm Vehicle

Farming in India is very labor intensive and labor shortage is a big concern with most farmers. With this contradicting situation, it is important to design a smart farm vehicle.

The team interviewed farmers and their family members. They paid multiple visits to the farms to see the farmers walking and realize how a farming family's day is generally spent. We could collect a lot of valuable insights by asking

a lot of open-ended questions and observing the way the family responds to the questions. The outcome of the exercise was a women-friendly tractor which is easy to mount and drive under rough terrain conditions.

Project 4 – Traffic choking on road to Zero Point within Mahindra World City (MWC), Chengalpattu
The road leading to Zero point (the entrance to MWC) gets clogged by traffic during the busy hours of 8-10 in the morning and 5-7 in the evening. In 10 years from now the number of vehicles plying on the road is going to further increase leading to further choking. The team's objective was to come up with implementable solutions that reduces the intensity of the problem.

The team interacted with Mahindra World City Administration Department, the different company admin team who run buses and other shuttle services within Mahindra World City, employees of various companies who use shuttle service and regular train service to enter Mahindra World City and the bus and auto drivers. The collected a lot of valuable insights which could be translated into reasons for the massive choking that happens during peak hours. There was a lot of conflict of interest between parties that had to be accounted for while designing the solution. Applying the design thinking techniques, the team could come up with brilliant solutions which has the potential to decongest the area soon.

Project 5 - Farming is plagued with a lot of perennial issues that once solved will ease the life of millions in India. The project team was trained in the Design Thinking methodology and could interact at length with farmers from different villages of Tamil Nadu. One of the techniques that the team used in collecting valuable insights from the farmers was Draw Your Day. In this methodology an interviewee is asked to draw with simple figures describing one complete day of his regular life. The drawn picture of one of the farmers was interesting - he showed getting down from the tractor multiple times within an hour while he is preparing the land for sowing. When he was enquired with many open-ended questions, the farmer pointed out that he must get down of the tractor several times to clean the rotavator (and implement used to puddle land) which accumulates a lot of mud during operation and reduces the efficiency of the process.

Engineers at Mahindra Research Valley could come up with multiple novel ideas of designing a self-cleaning rotavator. The unspoken rational need of the farmer, a self-cleaning rotavator, could be unearthed using Design Thinking technique.

Conclusion

This new era is not only a shift in tools, it's a shift toward employee-centric design. Just as we use apps like Uber to locate a ride or like Swiggy to order food, we need learning and information support to be as easy and intuitive to use. Shifting from "instructional design" to "experience design" and using design thinking are key here. And we must look at employees' journeys at work, so we can produce learning that is simple and easy in the flow of work.

We at Mahindra Research Valley believe that Design Thinking workshops are a strong lever to making an organisation more innovative and for approaching problems in novel ways. By working together in a collaborative way's organisations can explore the motivations of human factors in product design and learn a strong cultural level for innovation.

Appendix

Fig. 1 Participants go through the online module on NPTEL/ Swayam portal taught by Professor and Innovation Consultant, Dr. Balachandar Ramadurai

Fig. 2 Participants clear the online exam based on the e-module

Fig. 3 Participants form teams and enact from users' perspective the various problems given to the other teams to solve

Fig. 4 Teams make field visits to collect further valuable insights

Fig. 5 Teams present their analysis based on various insights

Fig. 6 The trainer, Dr. Balachandar Ramadurai guides the teams in the workshop

Fig. 7 Quick and dirty prototypes made my teams to explain their solutions

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