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Creating a Highly Engaging and Collaborative Environment in MOOCs - Based Remote Learning Through a TRIZ-Based Systematic Innovation Approach

Sayantan Mukherjee and Shankar Venugopal

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First author:

Sayantan Mukherjee

Innovation Manager

Mahindra Research Valley, Mahindra and Mahindra Ltd., Mahindra World City, Kanchipuram District, Chengalpattu, Tamil Nadu 603004

mukherjee.sayantan@mahindra.com

Second author:

Shankar Venugopal

Vice President, Technology Innovation and Dean, Mahindra Technical Academy

Mahindra Research Valley, Mahindra and Mahindra Ltd., Mahindra World City, Kanchipuram District, Chengalpattu, Tamil Nadu 603004

venugopal.shankar@mahindra.com

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Abstract – "The reason why it is so difficult for existing firms to capitalize on disruptive innovations is that their processes and their business model that make them good at the existing business actually make them bad at competing for the disruption"- Clayton Christensen. When companies prepare themselves to meet the disruptive forces, the very first task is to quickly train their employees on various disruptive trends and technologies. Training at this large a scale, need big investments – of money from the businesses and of time from the employees - these are scarce resources in the current VUCA world.

We, at Mahindra Technical Academy, tried to scale up our trainings, while keeping the cost low, by building rich digital content and started exploring a blended learning approach. However, effectiveness of various remote training methodologies has always been under the radar - a recent study pointing out while 6% of MOOC learners finished their courses during 2014-15, only 3.13% completed during 2017-18. This demands for a major revamping of the remote training methodology. It is important to understand the underlying disadvantages of the current system that act as deterrents to learners' education eventually failing to capitalize on the learners' curiosity.

We used a powerful structured innovation methodology – TRIZ (Theory of Inventive Problem Solving) – to overcome the disadvantages and remove the deterrents. We first identified the root cause of the existing shortcomings. After identifying the causes, we proceeded to find ways to overcome the disadvantages by formulating contradictions (that arise because improving a certain parameter worsens another parameter). We resolved these contradictions systematically by using TRIZ Inventive principles. The result of following such a structured innovation methodology is a redesigned Remote Training process with higher learner engagement and higher effectiveness of Digital learning while promoting a collaborative ecosystem of learning.

Keywords – Massive Online Open Course, e-Learning, MOOCs, TRIZ, Innovation, Problem Solving

The Needs of the VUCA World

The era that we are in is shaping itself in a way not known to us before. Popularly known as the VUCA (abbreviation for volatile, uncertain, complex and ambiguous) world in the corporate domain, the current business scenario can be traced to the impact of disruptive technologies and radically new business models. When companies set out to bravely meet these changes, they realized very quickly that their strategies (that worked earlier when the future was predictably evolving at a linear rate) did not work. A spectrum of disruptive technologies is redefining the design of new products - digital technologies like Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT) enable the creation of smart and connected products. Exponentially evolving technologies like additive manufacturing, advanced materials are also changing the way these products are manufactured. Business models which previously used to bring steady revenues for the companies are no longer able to promise a safe future – the power of platforms in enabling the rapid growth of a new generation of companies that thrive on shared assets. When these exponentially growing new technologies are reshaping the entire industry, companies struggle to let go the old technologies and adapt to new technologies and create sufficiently differentiated products to stay in the lead.

Coxe Distinguished Professor at Dartmouth College's Tuck School of Business, Vijay Govindarajan advised a unique strategy to tackle such a tricky situation. This strategy is known as the Three-Box Thinking (1). Dr. Govindarajan suggests that companies should create three Virtual boxes under which they should categorize their various activities. Box one should have activities that a company should continue doing as before to run the current business. These activities should ensure that the current cash flow to the business is active. Box to should have activities that the company should immediately stop doing. These are the ones that either is slowing down the

progress of the company or are not bringing enough value to the system. Box 3 should have activities or things that the company should start learning or doing afresh immediately to hold its position in the market in future. Corporates do realize the value of this strategy and they invest in preparing their employees for the forthcoming future. They train their employees in various future competences to ensure that the employees are better prepared when it matters the most.

Corporate Trainings – the limitations

Most of the big corporates operate from various locations across the country. Due to their presence in various geographies it is difficult for this Corporates to arrange a seamless training process for all the employees working across the breadth of the organisation. Though it is essential to train employees, a company also needs to ensure the ongoing projects stay on track. On an average, a new project (in an Auto and Farm Company) timeline ranges somewhere between 30-40 months. The timeline has multiple gateways which a project must clear to ensure smooth launch. A delay in launch may mean losing crucial market share to competitors. Thus, there is always a pressure to complete job on time. Training engineers for reskilling often requires extensive participation of learners which affects project timelines. The most predominant training process in the corporate world is the workshop or classroom sessions. This workshop mode requires 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 Existing Alternative and its constraints

A solution to the current limitations is use of online training modules or MOOCs. 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. The online training modules are cost effective as well. Organizations can train a lot of employees repetitively using the same content uploaded just once by the trainer.

But various studies show that only 5-15% of learners who enroll for online training actually complete the modules. This makes the online training program for employees in Corporates non-impactful. Only if online courses could be made more effective, corporate training programs would have been more convenient and budget friendly. Thus, it becomes very important to analyze why at present online courses or MOOCs are not effective enough for the learners.

Systematic Problem-Solving method – TRIZ

A good analysis of the shortcomings of existing the system should help to bring out the underlying problem. For this we have applied a systematic innovation methodology known as TRIZ. Using TRIZ, we will show how we can bring out the underlying problem in the existing online training system and eventually formulate solutions that are going to make online learning enjoyable and more effective.

The TRIZ methodology follows an orderly structure: -

Stage 1 - We examine the Target disadvantage of the existing system and then define the Key disadvantage to be solved. Target disadvantage is defined as the problem statement that comes directly from the user or the one facing the problem. Most of the times the problem statement as stated by the user turns out to have multiple underlying problems. Also there remains a lot of subjectivity in the problem statement given by the user. To come up with a relevant objective solution it is thus important to dig out the hidden problem statement(s). It is a two-step approach where in

the first step we move to the Intermediate disadvantage(s) from the Target disadvantage as stated by the user. The Intermediate disadvantage(s) is identified by creating the function model of the system in question. Function model is a diagrammatic representation of the relation shared between each subsystem and supersystem components. With the diagrammatic representation of the relation shared between the super system and the subsystem components, we analyze whether the relation is useful or useful but low on efficiency or harmful. Relations that are useful but low on efficiency or harmful are then examined to identify the Intermediate disadvantage. Sometimes there are situations where an Intermediate disadvantage may arise because of a missing relationship also. Before we generate the function model of the system, we break it down into its subsystems and super system components. Subsystem components are those that forms the system itself or are part of the system. Super system components are those with which the system directly or indirectly interacts with. In the second step, we dig further deep into the Intermediate disadvantage(s) using a method called Root Cause Analysis to derive the Key disadvantage(s).

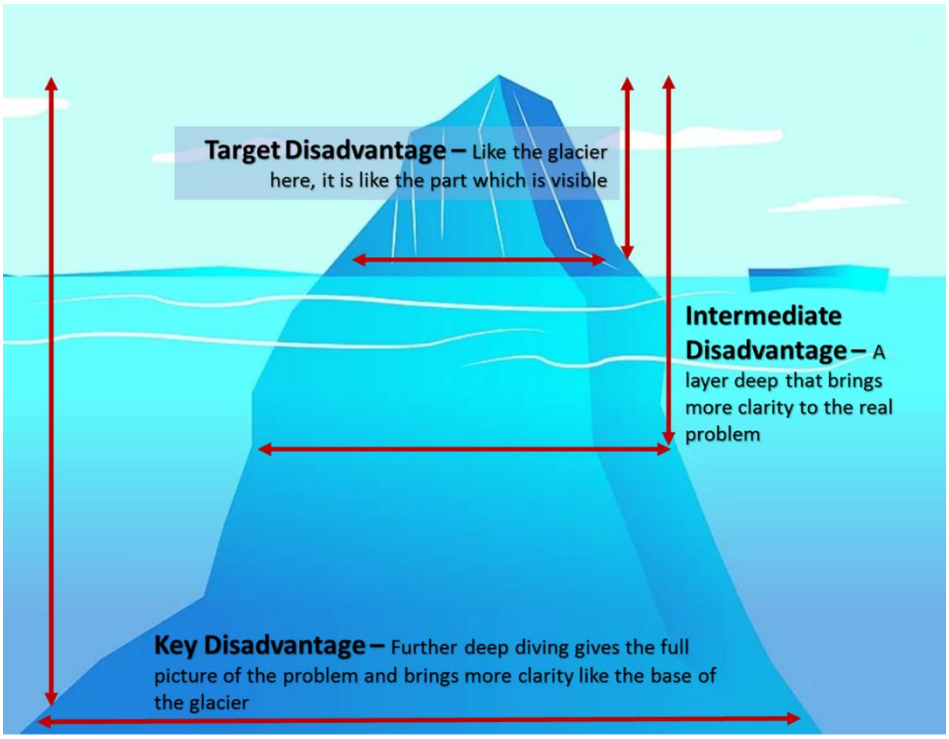

Fig 1. Analogy of Target, Intermediate and Key Disadvantage with Iceberg sighting

Stage 2 - Once the Key disadvantage(s) is defined we start formulating the contradiction statements. Contradiction arises when improving one parameter of the system results in deteriorating another parameter of the same system. Here we assume that both the parameters are equally important to the system. Another way contradiction arises is when the same parameter is required to have contradictory values at different situations. For a system to be inventive it is very important to identify the contradictions and resolve them. In TRIZ, there are mostly two types of contradictions - technical contradiction and physical contradiction. Technical contradictions are the ones that sees one parameter improving at the cost of another parameter. Physical contradictions, on the other hand, are situations where the same parameter of the system is required to have contradicting values at different situations.

There is a reason why it is important to formulate contradiction statements and resolve them using TRIZ methodology to come up with inventive solutions. The problems that we encounter in our daily life often leads to a lot of contradictions. When we encounter a contradiction, we tend to optimize the solution – thus, we compromise with our expected results. Resolving contradictions using TRIZ methodology, an inventor comes up with novel solutions while fulfilling the requirements of both the contradicting situations. The not-been-tried-out solution thus becomes inventive.

Stage 3 - There are 40 inventive principles framed by Genrich Altshuller, the creator of TRIZ methodology. After the Stage 2, once we have formulated the contradictory requirements, we apply these Inventive Principles to come up with solutions. Contradicting requirements are formulated in such a way that they lead to generic problem statements. TRIZ inventive principles then provide generic solutions to those generic problem statements. An inventor should then convert the generic solutions into domain-specific solutions while considering the generic solutions as triggers to coming up with the novel ideas.

Applying TRIZ to make MOOCs effective

According to the TRIZ methodology as explained in the previous section we initially defined the Target disadvantage as experienced by the user. Online training modules or MOOCs though are easily accessible at anytime from anywhere could not fulfill the Expectations of Corporate trainings. Corporate training planners found it less effective to train employees due to low completion rate. Employees rate classroom training or workshop mode to be more interesting than online training modules or MOOCs. So, we can define the Target disadvantage as 'Online training modules are less engaging and thus are of little interest for the learners'.

To define the Intermediate disadvantage of the system we first created the System Analysis Map. Fig 2. illustrates the system analysis of online training module. The Subsystem includes components like audio, video subtitles, knowledge of the trainer etc. The Supersystem includes components like Internet, Systems (Laptop/ PC/ Tab and their configurations), learner etc.

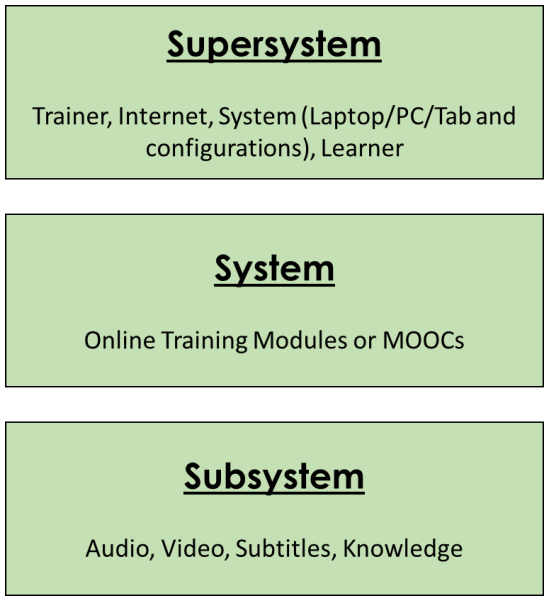

Fig 2. System Analysis Map of Online Training Modules or MOOCs

Now we generate the Function Model of online training modules to analyze the relation between various Subsystem and Supersystem components. The function model (Fig. 3) shows the relation between the super system and subsystem components of MOOCs. Though all the relations identified within the function model could be found as useful functions there is one missing relationship between the component trainer and learner. As mentioned before, classroom sessions are more effective than e-modules though being costly and time consuming - there exist a direct relationship between learner and trainer in a classroom session.

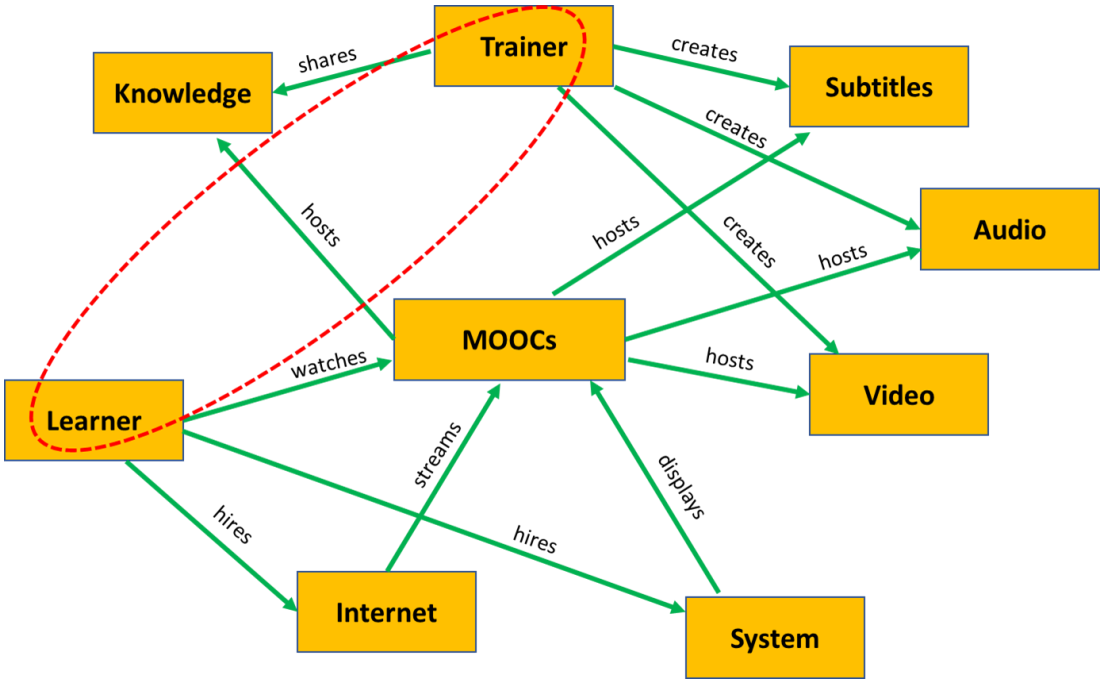

Fig 3. Function Model of Online Training Modules or MOOCs. The marked area (dotted in red) is where we see a missing link between the components Learner and Trainer.

Thus, we see that there is no one-to-one interaction between the learner and the trainer. This may lead to reduced engagement from the learners' side and interest to complete the training modules. This finding from the function model is also validated by Edureka's (a leading e-Learning company) research on e-learning dropouts (3) and other prominent researchers (4). Our Intermediate disadvantage thus can be

defined as – '**Learners feel less engaged in the uploaded content with no direct interaction with the Trainer**'.

We then move on to define the Key disadvantage of the system by further analyzing the Intermediate disadvantage using the process of root cause analysis.

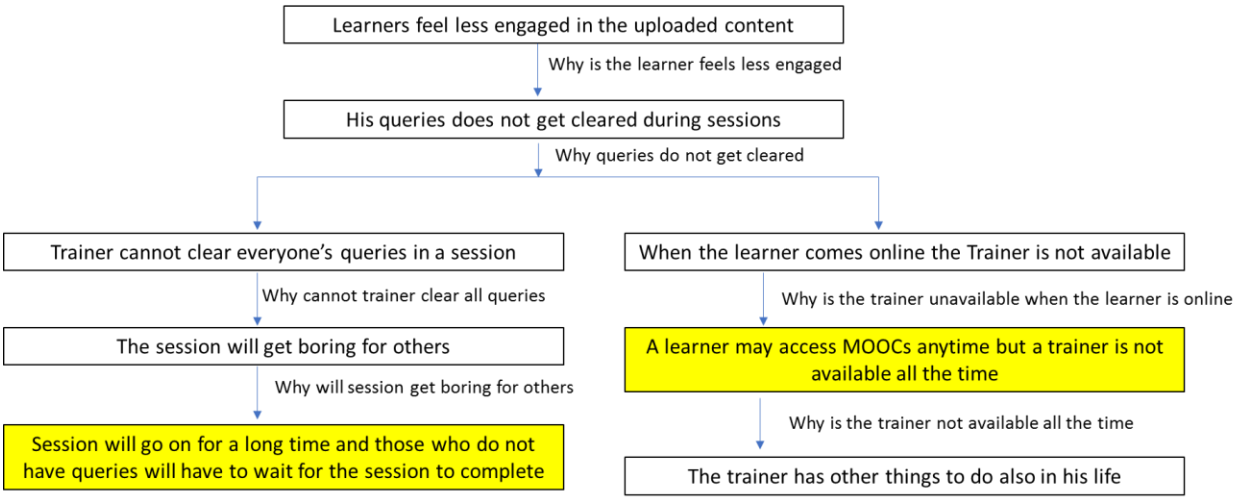

Fig 4. Root cause analysis done based on the Intermediate Disadvantage identified. The highlighted ones are the Key Disadvantages to be solved

With the defined Key Disadvantages, we formulate the contradiction statements.

Physical Contradiction formulated for both problems: -

i) Trainer should spend more time to teach all students individually, but Trainer should spend less time to ensure the course does not become boring

ii) Trainer should always be available to guide the student, but Trainer should also be unavailable to do his other work

The first Physical contradiction requires the trainer to spend more time with individual learners but when it comes to complete community of learners, the trainer needs to spend less time. This is a classic case where the contradiction can be resolved by Separation in System i.e. at the subsystem level, the students

individually must get more time to spend with the trainer's but at system level, the community should get overall less time.

There are few inventive principles that can trigger some ideas to help resolve contradictions using Separation in System: -

a) **Segmentation** – Artificially divide a system in parts in order to isolate harmful property
b) **Merging** – Bring parts of a system into a relationship that creates desirable outcome
c) **Homogeneity** – if two or more objects interact with each other they should consist of same information

These generic solutions then are used to come up with unique ideas:-

Most of the time learners feel disconnected because the course content becomes too generic and he / she cannot connect the learning to his / her area of expertise. Queries also become difficult to get clarified due to this generic nature of the content.

Using the triggers, we could come up with a novel process:

During enrolment to an online training module we should categorize (using Segmentation Tigger) the learners based on their functions (Marketing and Sales, Finance and Strategy, R&D and Manufacturing etc.). For example, if there is a training on Data Analytics, we may expect nominations from individuals with a wide range of expertise and domains. Their objective to join the course is to learn something new that they can apply in their function. We should create an add-on for each unique domain that has been nominated to the generic content – this will add value to a learner, and he /she will feel connected. This add-on may be in the form of function-specific extra content, function-specific assignments or a networking hub (using Merging and Homogeneity Tigger) for the similar domain (Sales and Marketing, Manufacturing and R&D etc.) learners for cross learning.

The second Physical contradiction requires the trainer to be available only when a learner is online. This is a classic case where the contradiction can be resolved by Separation in Time i.e. at the time, when learner is available the trainer must be available too but the trainer at other times can be unavailable.

There are more inventive principles that can trigger some ideas to help resolve contradictions using Separation in Time: -

a) **Rejecting and regenerating parts –** Remove portions of an object that have fulfilled their function
b) **Cushion in advance –** Perform before it is needed

These generic solutions then are used to come up with unique ideas: -

Since it is all about the doubts not getting solved during the time of learning, we may have chatbots clarifying doubts of the students. The trainers may feed the chatbots with answers to domain-specific FAQs (Using triggers Cushion in advance and Rejecting and regenerating parts). When there are non-obvious questions the chatbots may redirect the questions to the trainer who will come back with the answer whenever he / she is online.

Thus, the Highly Engaging and Collaborative MOOC model may look like this:

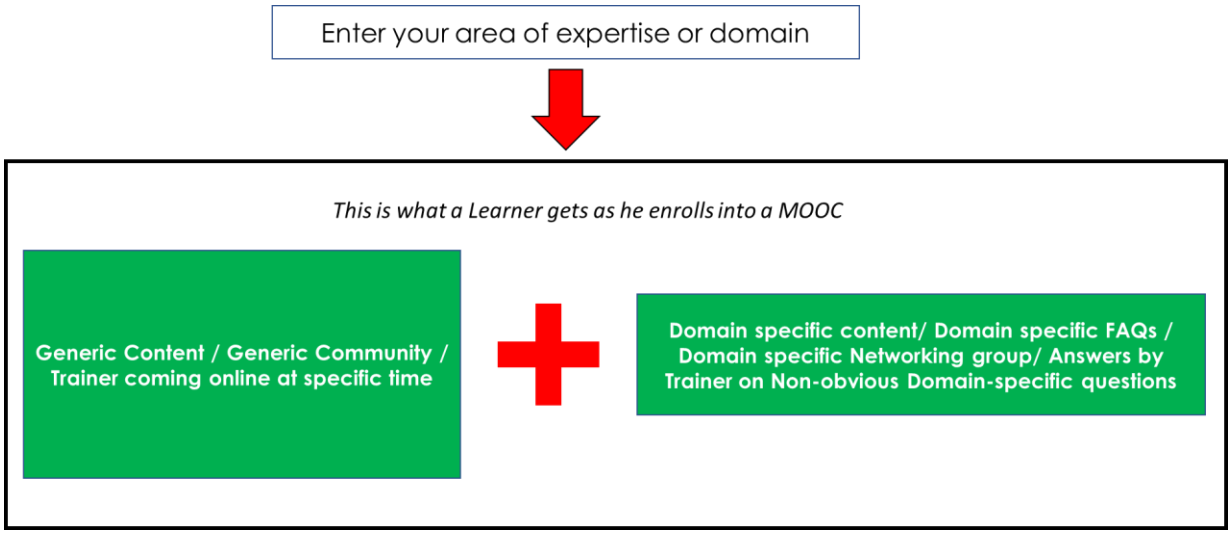

Fig 4. Highly Engaging and Collaborative model of Online Training Modules designed using TRIZ

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