

Learning experience interaction (LxI): Pedagogy for peer-connect in MOOCs

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Abstract: Massive open online course (MOOC) platforms have been found to be a desirable mode for Teacher Professional Development (TPD) activities as it allows increased opportunities to connect teachers engaged in PD. This connect allows teachers to engage in collaboration, share knowledge, discuss concepts and techniques, suggest application and additional learning material. In the MOOC setting, we term this as peer-connect. Every MOOC designer tries to increase the peer-connect through various channels available in MOOC, especially discussion forums. However, discussions in the MOOC forums have been criticized for being scattered, tentative and engaging only few learners. Existing attempts in improving the method of forum design were found to have mixed results. In this paper, we present a pedagogy designed around the discussion forum aimed at leveraging peer-learning in a 6-week TPD MOOC. The pedagogy is named as 'Learning experience Interaction' (LxI) and contains a focus question driving a discussion thread followed by a reflection quiz on the discussion to incentivize the participation. The effect of this pedagogy was analyzed through a mixed-methods research, wherein we obtained quantitative and qualitative analyses of the peer-connect and engagement of participants in the discussion forum. The results show a sustained engagement of learners in the discussion forum even after the course duration. A total of 1691 participants were active in the discussion forum and they generated a total of 29355 posts across 8 weeks. Qualitative analysis of the most active discussion thread in a week revealed that there were five different levels of interactions - *Opinionated elaboration, Elaboration, Superficial, Persistent interaction, and Asking information*. Majority (73.2%) of these discussions went beyond being superficial comments, and none of these deviated from the focus question.

Keywords: Teacher professional development, MOOC, Discussion forum, Engagement

1. Introduction

The arrival of Massive Open Online Course (MOOC) platforms have revolutionized the field of online education, impacting higher education curriculum, community outreach, professional development and corporate training applications (Anders, 2015). However, MOOC pedagogy has been criticized for focusing on the information transmission agenda (Fischer, 2014). Discussion forums in MOOCs, which are meant to enhance interaction of learners with their peers and instructors, can address this problem. Research suggests that these interactions do not usually happen, as the threads in the discussion forum engage less number of participants. Moreover, the threads are usually scattered, not allowing the new learner to make sense and connect with their peers (Mak et al., 2010). This problem adversely impacts the learning from discussion forums where learners are expected to explore knowledge together by doing cooperative activities such as "requesting help, answering questions, discussing concepts and techniques, suggesting applications and additional learning material" (Dubosson & Emad, 2015). In this paper, we refer to the learner interaction in these cooperative activities as *peer-connect*.

MOOCs have recently attracted interest among teacher professional development (TPD) community as a medium to facilitate co-learning among teachers at scale (Laurillard, 2016). Co-learning, which is a critical aspect of TPD MOOCs (Laurillard, 2016), can be operationalized through discussion forum participation. TPD MOOCs have experimented with the structure and format of discussion forum to mitigate the known problems and engage participants in the course

(Laurillard, 2016; Warriem et al., 2016). In this paper, we extend the work of Warriem et al. (2016) by presenting the evaluation of the pedagogical design behind discussion forum. We refer to this pedagogical design as Learner Experience Interactions (LxI). The LxI pedagogy includes a focus question, which drives the discussion in the discussion forum, and is followed by a graded reflection quiz (Figure 1, in section 4). The graded quiz incentivizes the forum participation. Thus, the main purpose of the LxI is to enhance peer-connect and leverage the opportunity of peer learning. We have implemented LxI in a 6-week TPD MOOC on ‘Pedagogy for effective integration of ICT for schoolteachers’ (ET611Tx). In this paper, we investigate the research question (RQ): “*What is the effectiveness of LxI pedagogy in enabling peer-connect?*” in the context of ET611Tx. To answer this RQ, we performed quantitative and qualitative analysis of discussion forum posts in the MOOC. We found that the participants were engaged in sustained discussions even after the course was over, creating 29355 posts in 8 weeks. The qualitative analysis shows 100% adherence of the discussions to the focus question, with 73.2% non-superficial posts.

2. Literature Review

Discussion forums in MOOCs are major avenues for interaction among participating learners who may be accessing the course from physically different locations. These interactions are crucial for ensuring student success and satisfaction in online courses (Frey & Alman, 2003) and additionally ensure a stronger sense of community (Ke & Xi, 2009). The asynchronous nature of the discussion forums provide flexibility for the learner to communicate at any point of time and the public nature allows these interactions to be visible for a larger group of learners (Nandi, Chang & Balbo, 2009). According to the connectivist theory of learning (Siemens, 2013), learners in an open and distributed learning setting explore knowledge together by doing cooperative activities such as requesting help, answering questions, discussing concepts and techniques, suggesting applications and additional learning material (Dubosson & Emad, 2015). We refer to this phenomenon as *peer-connect*.

However, limited participation of learners in discussion forums has been identified as a persistent and widespread problem within online courses (Hewitt, 2005). In MOOCs, discussion forums are additionally known to have challenges of being unfocused and filled with responses that are ‘tentative’ (Mak, Williams, & Mackness, 2010; Schweizer, 2013). Though this engagement contributes towards participation, the tentativeness or lack of focus means that participation alone is not a sufficient condition to ensure quality of discussion (Naranjo et. al., 2012). Strategies like tutor moderation, peer facilitation and discussion seeding have shown mixed results (Onah, Sinclair & Boyatt, 2014). Thus, there is a need for pedagogical strategies for discussion forum participation in MOOCs that would enable them to achieve quality peer-connect in the discussion forum.

This becomes even more critical when the MOOC platforms are used for Teacher Professional Development (TPD) as the connection to peers and sharing of teacher experiences are a critical aspect of learning during PD (Laurillard, 2016). Additionally, when teachers share their experiences, teaching knowledge, ideas and resources during a TPD activity, they create a shared repertoire (Akerson, Cullan, & Hanson, 2009). This shared repertoire can be used further to engage the teachers in communities of practice (Wenger, 1998) that will help in leveraging and sustaining the PD effort. Existing literature on TPD-MOOCs, though scant, recommend a blended approach that involves both structured access to resources as well as engagement of participants in discussions (Koukis & Jimoyiannis, 2017; Laurillard, 2016; Warriem et al., 2016; Vivian et al., 2014).

Laurillard (2016) recommends co-learning approach that solves this problem by focused discussion forums and external tools linked to the forums. Another approach shows that peer support in discussion forums, with minimum moderator interference, in solving organizational, technical and instructional problems promotes exchange of ideas among participants (Koukis & Jimoyiannis, 2017). Warriem et al. (2016) extended the idea of focused discussion further by incentivizing it with a graded reflection quiz based on forum participation. These three approaches provided evidence of increased engagement in discussion forum in terms of number of posts and number of active participants. However, these models have not examined the quality of *peer-connect* in the forums to generate quality discussions, which is the primary focus of this paper.

3. The MOOC context

3.1 Course Description

The MOOC, studied in this paper, was a teacher professional development MOOC offered to all school teachers through the IITBombayX platform (<https://iitbombayx.in/>). This 6-week course (ET611Tx) ran from April 6 to May 25, 2017, in an instructor-paced format with weekly release of content. The broad objective of the course was to facilitate the transition from teacher-centric to learner-centric teaching-learning processes with ICT in school classrooms. The course content covered topics like active learning, constructive alignment, effective integration of ICT tools like dynamic visualizations (animations, videos, simulations) and Google suite of productivity tools, writing assessment questions at different cognitive levels and designing learner-centered lesson plans for teaching with the chosen ICT tool.

The course materials, released each week, contained instructional videos, formative assessment questions, discussion forum adapted using LxI pedagogy and graded activities. There were also additional videos provided from external sources that demonstrated real-life application of the teaching principles discussed in the instructional videos. Learners were awarded an honor code certificate if they secured at least 25% aggregate score in the course. A focus question was posed to initiate peer discussion in the forum. Participation in the forum was incentivized through the weekly graded activity of reflection quiz. We termed this pedagogy as learner experience interaction (LxI) pedagogy, which is explained in section 4.

3.2 Demographic profile of learners

A demographic survey was administered to the 11,462 registered participants, out of which 7,022 responded. Analysis of the responses revealed that the learners were from 30 states and 893 cities of India. They were mainly from urban India, mostly in age group of 26-40 with majority having Master degree. They were from multiple domains like English (23.35%), Computer Science (16.48%), Mathematics (15.27%), Bioscience, Physics, Chemistry, Economics, Hindi, History and other domains. What was interesting to note was that 87% of them were first-time MOOC learners. Thus, it is challenging for them to engage in peer discussion over a discussion forum with peers who are practically strangers. Further details of the demographic profile of the learners given in Table 1.

Table 1

Demographic Profile of MOOC learners (N= 2892)

Gender	Male = 27% ; Female = 73%			In-service teacher	84%	
Age	<18 0%	18 – 25 13.4%	26 – 40 61.6%	41-50 20.3%	51-60 4.2%	> 60 0.5%
Educational Qualifications	School 2%	Bachelor's 29.8%	Master's 64.8%	Doctorate 2.3%	Others 1.1%	
ICT used in teaching	MS-Office 79%	Animation 70.9%	Google drive 34.5%	Wikis 21.9%		

4. Pedagogy of Learner eXperience Interaction (LxI)

The nature of MOOC pedagogy is evolving from being an instruction focused (i.e. teacher-centered) to a learning focused (i.e. learner centered) approach (Conole, 2014). The technology affordances of discussion forums in the MOOC platforms further extends the nature of the pedagogy to utilize connectivist principles of autonomy, diversity, connectedness and interactivity (Downes, 2010). The LxI pedagogy is designed as a learner-centric MOOC pedagogy to enhance peer-connect and leverage peer learning by anchoring and incentivizing participation in the discussion forum. LxI consists of three main structural elements:

- **Focus question** – Created by instructor to anchor discussions.
- **Discussion Forum** – Driven by MOOC learners and facilitated by course staff as needed.
- **Reflection Quiz** – Created by instructor to incentivize the discussion.

Figure 1 shows the dynamics of LxI with the role of each MOOC actor clearly highlighted. The instructor creates a focus question along with rules of interaction to anchor the discussion. While designing the focus question, an important consideration is to permit sufficiently diverse views from the MOOC learners to generate a shared repertoire. The primary role of facilitators, i.e. course staff, in the discussion forum is to ensure that discussions do not lead to unruly confrontations. They are also encouraged to post their own views and engage in discussions with the MOOC learners. The reflection quiz is a graded activity following the discussion.

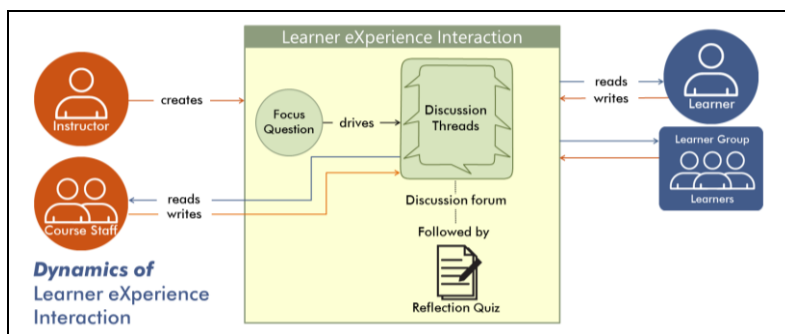


Figure 1. Dynamics of Learner eXperience Interaction

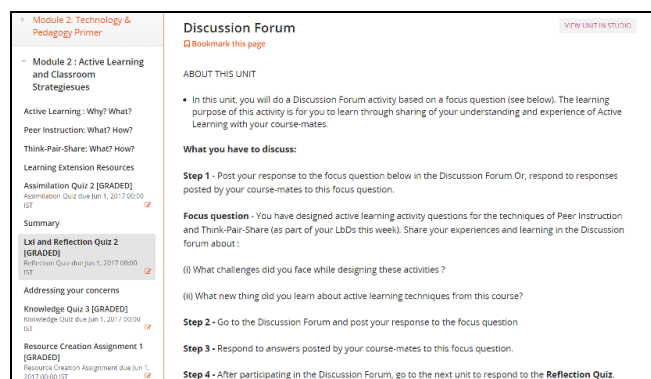


Figure 2. An example of focus question from the course ET611Tx

Figure 2 shows an example of the focus question and rules of interaction created in the ET611Tx course. The course content, corresponding to this LxI, discussed the topics of active learning strategies of (i) Think-Pair-Share and (ii) Peer Instruction, and had practice assignments for learners to design these activities. The specific LxI (in Figure 2) was aimed to expose the participants to the diverse challenges faced during creation of active learning strategies and encourage sharing of their own reflections on active learning. The structure of a discussion forum consists of three levels – Threads, Replies and Comments. Threads form the uppermost level and represent start of a discussion. The next level of discussion post is the reply and comments are the postings on these replies.

5. Research Methodology

5.1 Sample & Data Sources

Total number of 11,462 participants registered in the ET611Tx course. Out of which the active number of participants was 3,933. By ‘active’ we refer to those participants, who did not just register

in the MOOC course but also attempted at least one of the MOOC activities, such as videos, quizzes etc. The data used in this research comes from the discussion forum logs. These logs included the discussion texts posted by the participants and its associated metadata. The metadata included: (a) identifier for the participant who posted a text, and (b) date-time stamp of the post.

5.2 Data Analysis

The collected data was analyzed to measure the main constructs of engagement and peer-connect in the discussion forums. To measure the peer-connect, we relied on the following sub-constructs: (i) Extent of peer-connect (as described by the depth of social network created through the discussion forum activity); (ii) Quality of peer-connect (as described by the levels of interactions and quality of discussions). We now detail the data analysis procedure for each of these constructs, below.

Engagement of the learners refers to the extent of participation that learners have demonstrated in the discussion forum. This was measured by a quantitative analysis of the data from all the discussion forum threads in the ET611Tx. This included the frequency distribution of forum participants across different weeks and frequency distribution of the forum posts across each week. These two data elements provided us with an insight on engagement of the learners and their sustenance in the discussion forum.

Extent of peer-connect was analyzed by computing a force-directed network graph (Chernobelskiy, 2011), a known social network graph, for each week using a Python program. Each node in the graph represents a learner who participated in the discussion forum and their closeness to the center relates to the extent of their participation. The edges of this graph represent connections between the peers. The larger the number of edges, the greater is the peer-connect. We discuss in detail (Section 6) the social network graph of the week that had the maximum discussion activity (465 posts).

After compiling all of the discussion texts, we selected the discussion thread with maximum activity for the qualitative analysis. This thread was corresponding to the week of 'Active Learning' topic. The thread contained discussions pertaining to the focus question on "*challenges in implementing a specific active learning strategy 'Think-Pair-Share'*". We employed inductive thematic analysis (Braun and Clarke, 2006) to identify patterns in the discussions. We first performed open coding to inductively identify patterns in the data. Two researchers with expertise in qualitative research analyzed the data individually and then discussed their analysis to resolve the inter-rater conflicts completely. The researchers performed backward comparison in the dataset to validate and refine the open codes. After open coding, the researchers grouped the open codes further into focused codes (Strauss and Corbin, 1998) to get themes. These focused codes were further classified into two dimensions. The first dimension contained the focused codes related to "*levels of interactions,*" while the second dimension contained the codes related to the "*quality of discussion.*" By "*quality of discussion*", we refer to the *depth of knowledge* that the participants explored using the discussion. After thematic analysis, we performed content analysis (Cohen et al., 2002) on the first dimension, where we analyzed the discussion thread for extracting frequency distributions of each of the "*levels of interactions*". The themes emerged in the two dimensions are detailed in section 6.2.

6. Results

The effectiveness of the LxI pedagogy was measured in terms of two constructs: learner engagement in the forum discussions and the peer-connect established thereof.

6.1 Effectiveness of LxI : Learner Engagement

Learner engagement in the discussion forum refers to the engagement of individual learners in discussion forum activity. When large number of learners engages in forum activity, it is expected to lead to richer peer-connect. The learner engagement in this MOOC was gauged through the number of discussion forum participants and the number of forum postings per week and the percentage of active learners of the course who were forum participants. The course had a total of 1,691 unique

learners active in the discussion forum that generated a total of 9,909 threads, 14,617 replies and 4,829 comments (i.e. 29,355 posts).

Figure 3 shows the week wise distribution of engagement in discussion forum. The figure has a stack of number of active forum users (in green), i.e. learners who have either started a thread or commented on an existing thread in a particular week, against the total number of forum posts per week. Analysis of Figure 3 shows there were, on an average, 592 forum participants per week. The participation was highest in the third week when the topic of active learning was introduced. Figure 3 shows the number of forum posts per week ranged between 1,271 and 5,284. Comparison between the two bar graphs reveal that, though the number of forum participants remained approximately the same through the 6-weeks of the course, the number of forum postings i.e. the interaction between them was more with the introduction of core pedagogy topics from Week 3 to Week 6. These weeks saw more than 4,500 forum postings each week. Forum postings were comparatively lesser during the first two weeks that dealt with familiarizing learners with the MOOC platform and an ICT tool. Both graphs show engagement in forum was sustained even after the 6-week course was over.

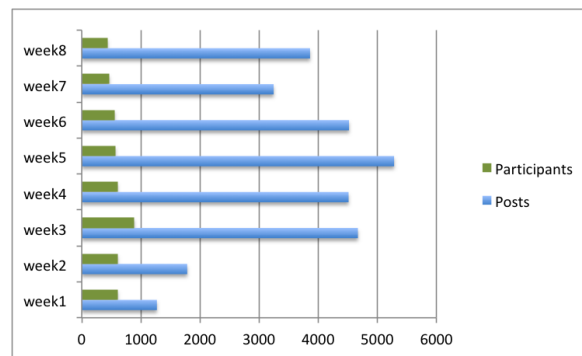


Figure 3. Week wise discussion forum engagement

Additionally, 43% of the active learners of the course had participated in the discussion forum. With majority being MOOC learners, this data points to the effectiveness of LxI pedagogy to motivate learners to participate in discussion with peers.

6.2 Effectiveness of LxI: Peer-connect

The quality of the peer-connect was analyzed through (i) social network graph (Figure 4) generated for the crucial week of ‘Active Learning’ where learner-centered teaching-learning principles were introduced in the course for the first time and (ii) qualitative analysis of the discussion that occurred in the most active thread (465 peer interactions) of that week.

6.2.1 Social network graph analysis

The graph in Figure 4 shows a force-directed network graph where each node represents a learner who participated in the discussion forum. The structure of the Open edX discussion forum used in this MOOC consists of three levels – Threads, Replies (shown in blue) and Comments (shown in brown). Since any participant can start a thread, a reference node (or null node) was created at the centre, which is connected to the nodes initiating a thread (shown in green). The nodes, which reply to these threads, are shown in blue and the comments on these replies are shown in brown. The nodes in the inner parts represent learners who have more participation in that week's discussion, in terms of threads, replies and comments (combined under the term posts). As the radius increases, the nodes in outer radius represent those discussion forum participants who had lesser participation in that week. A total of 888 learners engaged in discussion forum posting 4,671 posts.

Analysis of Figure 4 reveals a dense concentration of nodes at the center. This indicates high degree of interactions and information interchange took place between the learners. The dominance of green in the graph indicates a large number of threads were initiated and a large subset of them received substantial number of replies (blues) from other participants i.e. peer feedback. The number

of cones in the graph indicates many of the participants visited the forum multiple times to follow up on the threads, post replies or comment to replies. These data lends credence to the effectiveness of the LxI pedagogy. Each focus question in the LxI required the learners to do peer-review of the content posted in the forum and based on that review, they were to respond to a graded quiz. The focus question ensured the forum discussions were always on-topic. This in turn may have fueled the inherent eagerness of learners to receive feedback on their postings, which led to the generation of large number of threads. The incentive of graded activity may have prompted learners to visit the threads multiple times. Thus, the LxI pedagogy propelled the MOOC learners to establish peer-connect and carry out on-topic discussions.

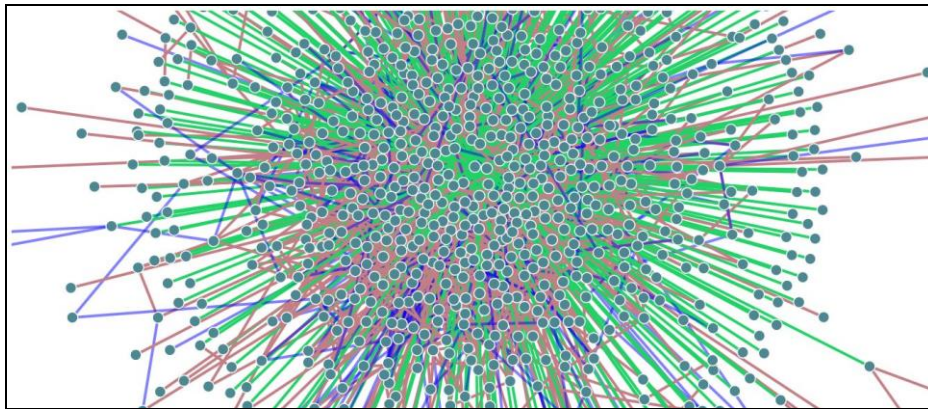


Figure 4. The social network graph for the week of ‘Active learning’

6.2.2 Qualitative analysis of discussion in Discussion Forum

The nature of the discussions in the discussion forum was extracted through thematic and content analysis of the most active thread (465 interactions) for the selected week. Thematic analysis of the forum discussions revealed five levels of interactions – Opinionated Elaboration, Elaboration, Superficial, Persistent interaction and Asking information which is listed in Table 2. The content analysis of the discussion thread provided the frequency distribution of these levels of interactions in the thread. Figure 5 shows this distribution, where Opinionated Elaboration (37.6%) and Elaboration (33.8%) emerged as the top two levels of interactions in this MOOC. Table 3 illustrates these two levels of interactions with examples.

Table 2

Definitions of qualitative codes for different ‘Levels of interaction’

Sr.No.	Interaction Level	Code Definition
1	Opinionated Elaboration	Referring to a previous forum posting (post/comment) and giving further elaboration
2	Elaboration	Not referring to any previous forum postings. But reflecting elaborately on the discussion topic and adding information
3	Superficial	Referring to a previous forum posting. But limited to saying good/agree without any further elaboration
4	Persistent Interaction	Replying to comments on one’s own forum posting
5	Asking Information	Asking for other’s opinions on one’s doubts

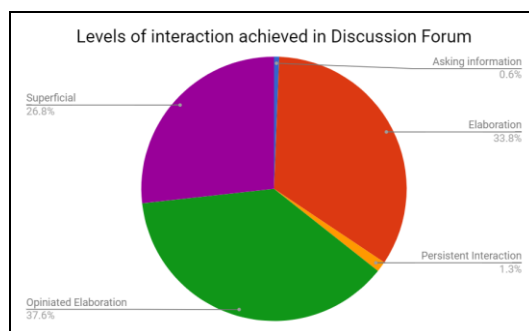


Figure 5. Content analysis of the different ‘Levels of interaction’

Table 3

Illustrative examples of the top two ‘Levels of interaction’

Interaction Level	Illustrative example
Opinionated Elaboration	“Hello xxxx, I'm sure you must be doing a lot of circle time activities in pre-primary. They are also a part of active learning as the students think and respond to our questions. Often when we give group activities, we find them discussing among themselves. By planning and preparing the questions carefully, I believe these techniques can be used for pre-primary too.”
Elaboration	“TPS is a great way to involve every one in the learning process. It can be applied to any age group. This gives space to those children who are shy and don't usually share in class. At any given time, we would find few smart, active students, who always love to share and speak, some loose out chance to speak, some till the time, they grab courage to speak, these active kids have snatched the change and few more, they never try at all because they know there are others how always takes initiatives. They prefer to be silent and observe. This way, every child gets their own peer comfort environment to share their thoughts. Some kids don't share in large group of class or in front of teacher, TPS that way they feel safe and ok to share with their peers. It's a great way for teachers to involve every child in sharing and discussion for learning, respecting each child's way of learning. Just try it with your kids ma'am, you will have stories to share with us here. Enjoy and happy learning.”

The above tables show that majority (73.2%) of the forum discussions went beyond superficial commenting. The discussions revolved around their reflections on how the teaching principles introduced in the MOOC can become a solution to the challenges they face in their own teaching practice. This underlined the efficacy of the LxI pedagogy in prompting self-reflection among MOOC learners to make connect between the course content and their teaching practice. Additionally, 100% of the forum discussions were found to be on-topic, aligned with the focus question of LxI. Thematic analysis of the forum postings for the selected thread on ‘*Challenges for active learning*’ also helped in decoding the range of aspects of ‘*active learning*’ that the forum participants brought up themselves through peer discussion. The aspects i.e. themes that emerged were:

- a. Benefits of the active learning pedagogy in terms of the cognitive and affective domains and its ability to address learner diversity that they encounter in their classrooms.
- b. Challenges they expected in implementing active learning in their classrooms.
- c. Experience sharing by forum participants who have already implemented active learning in their classrooms. The experience sharing included advice on choice of topic suitable for active learning, experience about classroom management and student response when using active learning strategies and challenges faced while designing active learning activities.

- The experience sharing in effect boosted the learning experience since it expanded the knowledge provided by the course contents.
- d. The forum discussions also provided reinforcement for positive pedagogical belief about active learning.

7. Discussion & Conclusion

To answer the RQ: “*What is the effectiveness of LxI pedagogy in enabling peer-connect?*” we analyzed discussion forum posts both quantitatively and qualitatively. We found that the LxI pedagogy enabled sustained engagement and enhanced peer-connect. 43% of active learners were engaged in the discussion forum throughout the 6 weeks of course offering. The social network graph and qualitative analysis of the discussion thread with maximum activity revealed that the quantity and quality of peer-connect in the discussion forum was high. The total number of posts per week, the percentage of active learners involved in discussion and the sustenance of the engagement are higher than the engagement statistics reported in similar earlier efforts (Warriem et al., 2016; Laurillard, 2016).

In addition to the broad quantitative results, the qualitative analysis of the discussions shows that there were five different levels of interactions - *Opinionated elaboration, Elaboration, Superficial, Persistent interaction* and *Asking information*. The content analysis of the forum posts revealed majority of them (73.2%) went beyond superficial comments. Higher frequencies of *elaborations* and *opinionated elaborations* in the discussion imply that LxI pedagogy has enabled the learners to reflect deeply on the focus question and elaborating with additional knowledge. The LxI was also successful in generating discussion that completely (100%) adhered to the focus question. Thus the LxI pedagogy was able to address the challenge of forums discussions being scattered and tentative (Mak et al., 2010; Schweizer, 2013). The thematic analysis has shown that the learners reflected on the application of course content into their practice, and also shared their experiences of the field implementation of the course content with their peers. This signifies depth and shift in ownership of professional development to participating teachers, both of which are crucial dimensions in the scalability of the TPD (Coburn, 2003).

A major limitation of this work is that we have not presented the analysis related to recurring participants or the most engaged community of participants within the discussion forum. Another limitation is that the qualitative analysis was limited only to one thread in the discussion forum and did not involve other threads that had lesser participation (as evident from the social network graph). A reason for this is that the current work is in the initial phase of research on peer-connect in TPD MOOCs. In future, we will expand our analysis to include various other facets of peer-connect and get more insights into the contributing features of LxI.

To conclude, this paper has presented an evaluation of the LxI pedagogy and provides evidence that reasonable levels of peer-connect in a TPD MOOC can be achieved through this pedagogy. The pedagogy helped in engaging TPD participants to engage in on-topic discussion on their practice, even though majority of them were first time MOOC learners.

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