Learner-centric MOOC for teachers on effective ICT integration: Perceptions and experiences

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***Abstract*—Massive open online courses (MOOCs) are lately being explored to meet bigger needs in the field of education. However, despite the global presence and scale, some critical challenges still persist in MOOCs. Some of these reported challenges include lack of learner engagement, limited interactivity and feeling of isolation, all of which in turn contributes to low completion rates. These issues could be addressed through innovative teaching and learning strategies, based on the existing body of work on learner-centric approaches and active learning in online modes. In this paper, we report the design, implementation and evaluation of a learner-centric MOOC for teachers on the effective integration of ICT in schools. The present study focuses on the evaluation of teachers' perceptions of usefulness of the learner-centric approach employed in the MOOC, their learning and application of the MOOC content, and the effectiveness of the course in terms of participants' perseverance in the course. Quantitative and qualitative data analyses were performed for two offerings of the course. From the quantitative analysis of a survey questionnaire, the average usefulness of the learner-centric course elements, over both course offerings, was found to be 89.5%. Qualitative analysis showed that 23% (T1) and 21% (T2) of the participants, who completed the course, explicitly mentioned LCM elements as a factor to persevere in the MOOC. The positive perception of the participants towards the course was related to their understanding of concepts, LCM structure, learner-centric activities and strategies employed during the course, and their desire to implement these strategies in the classroom utilizing ICT tools.**

Keywords—learner-centric MOOC, active learning, effective integration of ICT, teacher professional development

I. INTRODUCTION

Massive open online courses (MOOCs) play a vital role in higher education online learning, catering to an enormous diversity of learners, including school- and college-level students, working professionals, and teachers [1]. The scaling potential of MOOCs is being explored to meet critical needs in the field of education [2]. Despite the global scale, a wide range of courses and high number of enrolments, some critical challenges still persist in MOOCs. Some of these reported challenges include lack of learner engagement, limited interactivity, and feeling of isolation and boredom, all of which in turn result in low completion rates [3, 4]. Such MOOC scenario has been attributed to many factors such as, reproducing the classroom lecture format, ignoring the innovative developments in online learning while designing the teaching-learning strategies, and not considering the established theories of how people learn [4]. These issues could be addressed through established effective learner-centric strategies, such as interactive exercises, peer-to-peer learning, collaborative assignments and projects, and so on.

To address some of the above mentioned limitations, we designed and deployed a teacher professional development (TPD) MOOC (ET611Tx) based on a learner-centric MOOC (LCM) model. Though the use of MOOCs for TPD is still not very common, it is growing [5]. The TPD MOOC of our study focused on the effective integration of information and communication technology (ICT) in schools. The distinctive elements of this TPD LCM model included learning dialogue (LeD), learning by doing (LbD) activities, learner experience interaction (LxI) and learning extension trajectories (LxT), to foster active learning amongst the participants.

The MOOC provided research-based and learner-centred pedagogy for integrating ICT into teaching practices. Participants of this MOOC were teachers from schools all over India. The present study focuses on evaluating this learner-centric TPD MOOC on 1) teachers' perceptions of usefulness of

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the employed LCM elements, 2) perceived intentions of teachers in future implementation of course learnings in their teaching practices, and 3) the effectiveness of the course in terms of participants' perseverance in the course.

II. Related Work

A. Active Learning Approach in Online Education

Though the use of online education is on the rise, inspiring many new technologies, the effective use of the features of online learning for student engagement and learning are still being explored. Literature reflects upon the critical role of active learning in promoting learner engagement and better learning outcome [6]. Many active learning strategies have been explored in online learning, with a shift in the role of an educator from authoritarian expert to a facilitator, and that of passive learner to an active participant and knowledge seeker [7]. Some of these strategies used in online learning include quizzes, online discussions, community building projects and experiential learning with writings, to name a few.

One of the studies presented a set of ten MOOC design principles drawn from learner's perspectives [8]. Some of these design principles included competence-based design approach, learner empowerment as active participant, clear orientations, collaborative learning, peer assistance and feedback, and use of technology to enhance learning. A recent review investigated the three top-rated MOOCs from different disciplines to understand the reason behind their success [6]. Some of the factors, ranked in terms of importance, included problem-centric learning and simple explanations, instructor accessibility and passion, active learning, peer interaction, and helpful course resources. Active learning strategies incorporated in these MOOCs included quizzes assessing cognitive processes and providing immediate feedback; allowing multiple attempts at quizzes; multiple-application-based assignments; peer review with feedback and multiple peer assessment strategy; inserting video lectures with ungraded questions; forum for peers to interact; and optional practice exercises. Many of these findings agree with the principles of effective teaching, suggested by Chickering and Gamson (1987), which provide a framework for learner-centred teaching and learning guidelines [9].

Another MOOC-based study [10] explored the benefits of learning by doing, which included activities such as quizzes, exams, discussion forum participation and interactive activities with feedback. Students doing more activities were found to learn more than students watching more videos or reading more text. As online education continues to grow, learners are becoming more independent and responsible for their own learning. Educators are also starting to embrace their roles as facilitators, using active learning strategies to enhance learning.

B. Teacher Professional Development Courses

Teacher professional development programs aim to improve the teaching-learning practices of teachers, focusing on their intellectual, motivational, procedural and productive elements [11]. Researchers have suggested TPD programs to increase their understanding on the relationship between technology, pedagogy and content [12]. The impact of TPD on the instructor can be assessed as changes in knowledge and skills, and changes in attitude and beliefs that lead to teaching practices, ultimately improving student learning [13]. Few of the studies have also employed train-the-trainers model of TPD [14]. The practice of training a group of teachers, who then become responsible for training a new group of colleagues, has supported the scale-up of many smaller efforts. Though the use of online resources for TPD programs is still gaining a foothold, several teacher training programs have been conducted towards technology integration for effective teaching practices [5,15, 16].

A study, reporting that 83% of MOOC participants hold a two- or four-year post-secondary degree, has promoted the shift in MOOCs from traditional academic learning to career development offerings [17]. One of the emerging potentials of MOOCs in TPD include the effective adoption of ICT in education. While Coursera offers several courses specifically towards TPD, one of the MOOCs targeted towards promoting the use of ICT in primary education showed success in terms of ratings and participants' evaluation [18]. The pedagogy of this MOOC followed the standard continuing professional development format of curating resources and orchestrating peer collaboration. Literature suggests that employment of MOOCs in TPD is poorly researched [4]. Some of the challenges lie in designing effective TPD programs incorporating active learning strategies, evaluating their impact on teachers, and its applicability to their educational practices [19].

III. Pedagogical Basis of the Learner-Centric Model

The LCM model informs the design of a MOOC that incorporates learner-centric approaches. It is based on the principles of active learning, formative assessment, peer-learning, and addresses learner diversity. The elements of the LCM model are:

Learning Dialogue (LeD): LeDs are short videos providing conceptual knowledge, with explicit spots for the learner to express prior conceptions, perform micro-practice or reflect. These spots are known as reflection spots (RS), at which the instructor poses a question (such as an automated multiple choice question), and makes learners perform a brief activity (such as writing in their notebook). The learner is expected to pause the video, and respond to the question or activity. The RS is followed by the rest of the video, wherein the instructor addresses common expected responses, and summarizes.

Learning by Doing (LbD) activities: LbDs are formative assessment activities (allowing multiple attempts), designed by an instructor for students to check their level of understanding, apply concepts, or integrate knowledge. Each LbD provides learners with constructive and customized feedback that guides them to improve their learning. The feedback can either be designed by the instructor as an automated system response, or as a self-assessment review, or given in a peer-review process.

Learning Experience Interaction (LxI): LxIs consist of a discussion forum guided by a focus question. The goal of the focus question could be to elicit diverse learner views or experiences, or share learner created artefacts. The focus question requires the learners to interact with their peers by viewing and responding to others' posts. Each LxI discussion is followed by a short graded activity called the reflection quiz, in which learners reflect on the interaction by answering specific questions related to their experience in the discussion forum. Peer review is also a part of LxI activity which aids in providing effective peer feedback. The focus question in an LxI ensures that the discussion does not scatter, and the reflection quiz ensures learners' participation.

Learning Extension Trajectories (LxT): LxTs provide a variety of resources to advance learning, and cater to the needs of diverse learners in a MOOC. Each trajectory includes resources such as additional readings, videos and links with specific goals such as ensuring pre-requisites, increasing the depth or breadth of learners' existing knowledge, or supporting learners' language needs. These are followed by a short graded activity called assimilation quiz to ensure that learners assimilate the key concept from the resource.

IV. TPD MOOC DETAILS

The TPD MOOC, titled 'Pedagogy for effective use of ICT for school teachers', was conducted through IITBombayX, a MOOCs platform in IIT Bombay. The course was offered twice: spanning six weeks (April-May, 2017) in its first offering (T1), and four weeks (October-November, 2017) in its subsequent offering (T2).

The goal of the MOOC was to train school teachers in learner-centred pedagogy and constructive alignment for effective integration of technology in their classrooms. This MOOC aspired a shift from the teacher-centric view towards learner-centric model of teaching, and the course demonstrated how technology can be a facilitator for the same. The contents of the course included learning outcomes, active learning strategies (think-pair-share, peer instruction), assessment strategies, integration of visualizations, Bloom's digital taxonomy, alignment of assessment with learning objectives, and creation of lesson plans.

Figs. 1 & 2 show screenshots of two LCM elements in the TPD MOOC. Fig. 1 shows a Reflection Spot from a LeD on the topic of peer instruction. In the reflection spot, participants are asked to pause the LeD, and perform an activity relevant to the course. Fig. 2 shows an LxI containing a focus question for discussion, followed by a reflection quiz.

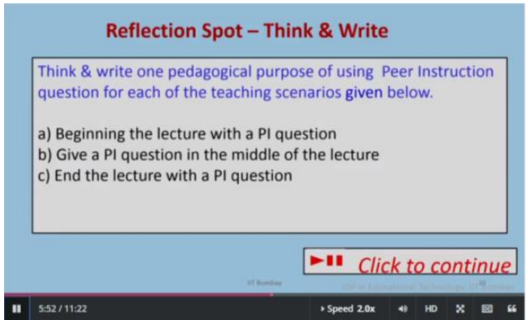

Figure 1. Screenshot of a Reflection spot in a LeD.

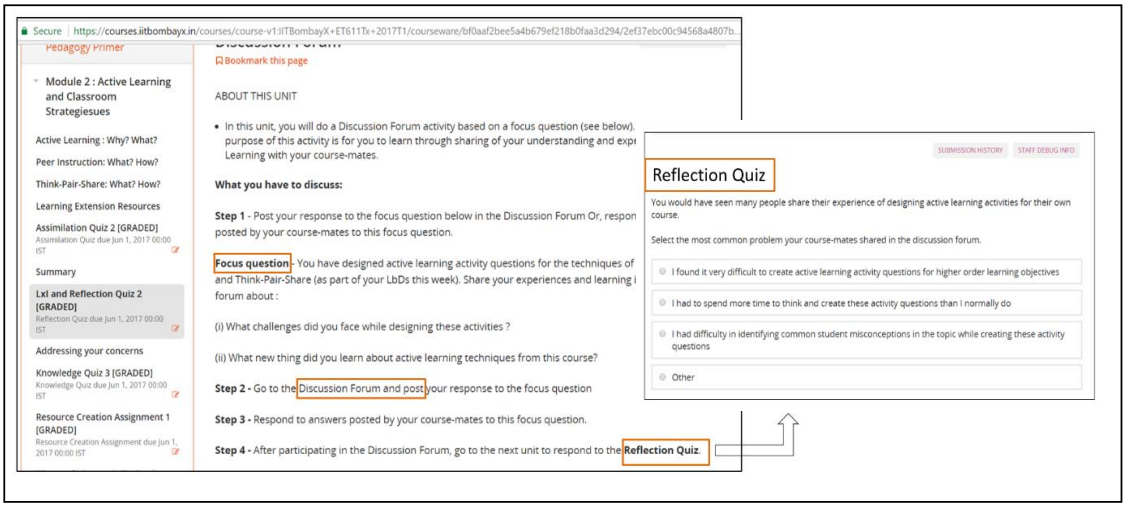

Figure 2. Screenshot of a LxI along with Reflection Quiz.

V. METHODS

A. Research Questions

The goals of the study were to evaluate both the content of the MOOC (understanding of active learning techniques, effective ICT integration strategies), and the pedagogical format (the learner-centric elements and strategies employed) of the MOOC. In this study, the term perseverance denotes the behaviour of being engaged, focused and persistent throughout the course in pursuit of learning goals [20]. The following research questions were investigated in this study:

1. What are the teachers' perception of usefulness of the course?
2. How successful was the course in terms of participants persevering till the end of the course?
3. What factors made the teachers persevere till the end of the course?

We investigated these research questions using a survey questionnaire containing both quantitative and qualitative aspects. Herein, results have been reported for two course offerings (T1 and T2), offered independently at different times in 2017.

B. Participants

A total of 11,462 (T1) and 2,596 (T2) teachers enrolled for the course. Out of these, 3933 (T1) and 1153 (T2) accessed the course material at least once after registration. These participants were labelled as 'active'. A subset of participants (245: T1, 278: T2), who persevered till the end of the course, responded to a survey questionnaire at the end of the course.

C. Study Instruments

Nine questions were chosen from the post-course survey questionnaire for our analysis, since they were most relevant to our study. The four aspects of demographic details included: gender, education, age and domain. Two quantitative analysis and one qualitative analysis were performed for the study. The first quantitative analysis was performed to understand teachers' perceptions of the overall usefulness of the learner-centric elements of the course. It was rated on a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree).

The second quantitative analysis was focused towards understanding teachers' perceptions in achieving specific tasks through the learnings of different course elements. Some of these tasks pertained to the content of the MOOC involving teaching-learning practices using active learning strategies, while some were focused on the format in which the LCM was approached. To come up with these survey questions, we reflected on the purpose for which the LCM elements were designed, and included survey items which conceptualized the purpose of the TPD.

The question in the second quantitative analysis consisted of several sub-questions, for each LCM element or activity, to be answered on a 3-point Likert scale (1-Low; 2-Medium; 3-High). To provide an example of the design, the following questions were asked for the LxI element.

Based on your experience, please rate the usefulness of LxI, on a 3-point Likert scale, to achieve the given purposes.

Were the LxIs of the course able to:

a. Connect with peers in my domain
b. Get feedback from peers about the resources that I created
c. See what problems others are facing while practicing constructive alignment
d. Share positive effects that I am seeing after practicing concepts taught in course
e. Identify possible technology tools that others are using in their own classrooms

The qualitative analysis, used for the study, involved an open-ended question "What were the factors that made you persevere in the course?" to explore the teachers' pedagogical experience with the course. This question allowed the teachers to think more deeply, reflecting on their learnings during the course, and have a voice regarding their experiences.

D. Data Analysis

The study used two types of data analysis: quantitative and qualitative. The quantitative data on the usefulness of the course was examined by performing frequency analysis of data from Likert-scale to yield percentages. The qualitative data obtained from the responses of the teachers provided detailed description on the factors that made them persevere in the course till the end. Content analysis of the responses was performed to understand their perceptions on usefulness of learner-centric elements in learning of the MOOC, and future implementation of ICT tools and active learning strategies in classrooms. Responses were categorized using open coding to classify teachers' conceptions, followed by frequency analysis for the same. The percentage of participants who successfully persevered till the end of the course were determined, based on the total number of initial teacher enrolments and total active participants for each course.

VI. RESULTS

The details on the end of the course demographic data of the participants has been illustrated in Fig. 3. Of the whole group (n=245 for T1, n=278 for T2), 23% of the respondents were males and 77% were females in each of the course offering. Majority of the teachers (55-58%) were placed in the age group of 27-40 years. The highest qualification attained by most of the teachers (62-69%) in the survey was a post-graduate Master's degree, which was followed by teachers (22-26%) with an undergraduate Bachelor's degree. The analysis shows that our TPD

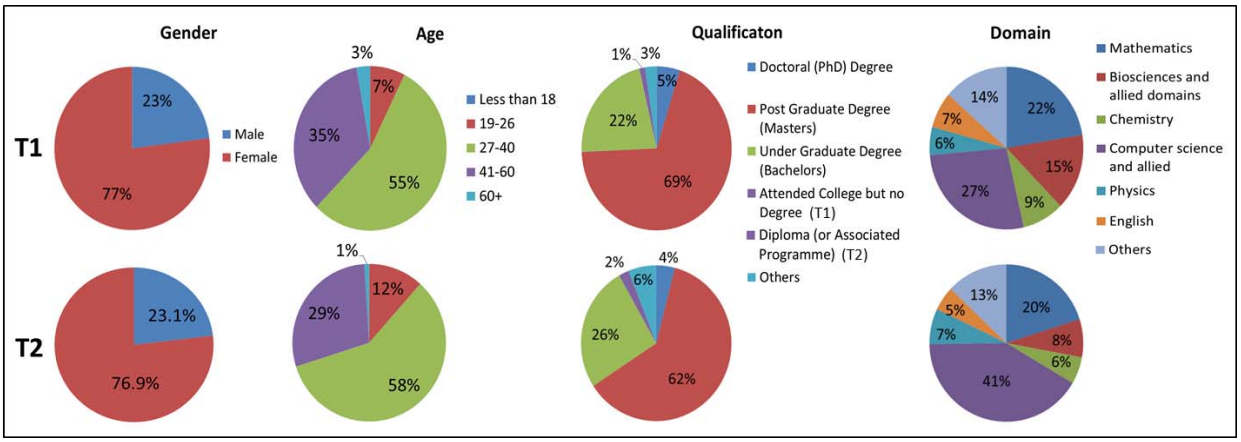

Figure 3. Demographic details of the participants for the two course offerings: T1 and T2.

MOOC catered to diverse audience of teachers from varied domains.

A. Quantitative Data Analysis

The results from the first quantitative analysis indicated that the average usefulness of all the course elements and both the course offering was found to be 89.5%. As shown in Fig. 4, there was a high average usefulness for LeDs (T1: 92%, T2: 91%), LbD activities (T1: 95%, T2: 94%), LxIs (T1: 78%, T2: 76%), LxTs (T1: 86%, T2: 90%) and reflection spots (T1: 91%, T2: 87%).

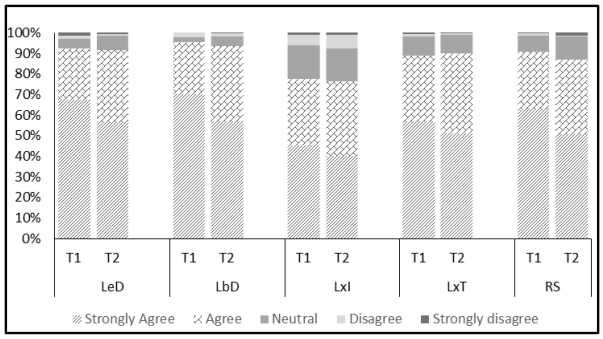

Figure 4. Perception results for usefulness of different LCM elements in T1 (n=245) and T2 (n=278).

The results from the second quantitative question were analysed on a three-point Likert scale (1-Low; 2-Medium; 3-High), assessing the perceived usefulness of the LCM elements for specific tasks. The teachers' perception in learning of these tasks is also a reflection of the effectiveness of the course. Majority of the teachers, in both the course offerings, rated the usefulness of the LCM elements as 'High' in reviewing of concepts, thinking more deeply about the content of the course, familiarizing with research and identifying more resources for educational practices, and identifying areas of improvement in their own practice (Fig. 5). In LxI, there was comparatively a lower response observed in getting feedback from peers and connecting with peers in the same domain. However, the overall strong positive perception of teachers' on the usefuless of the course elements, through deeper understanding of these tasks, is expected to positively enhance their teaching practices towards effective ICT integration.

B. Participants' Perseverence

A total of 11,462 and 2,596 participants enrolled along the course duration in its first and second offering, respectively. It was observed that 1704 (T1) and 418 (T2) participants successfully passed the course, resulting in completion rates of 14.9% and 16.1% for T1 and T2, respectively. The persistence rates, defined as the percentage of the active users who passed the course were found to be 43.3% and 36.3% for T1 and T2, respectively.

C. Qualitative Data Analysis

The content analysis of the qualitative open-ended question on factors that made the teachers persevere till the end of the course, showed different categories of conceptions that emerged amongst the teachers. Fig. 6 provides the frequency distribution for each of these conceptions. We now describe the benefits and aspects of each of these categories, as expressed by the participants, which made them persevere in the course. Examples of responses obtained from teachers, for each category, have also been cited.

LCM elements: The responses (23%: T1; 21%: T2) regarding LCM elements indicated explicit mention of one or more of the learner-centred pegagogies of the course, by the participant. This also incorporated responses on the well-defined structure of the course.

"*Interesting LeDs, LbDs and well planned quizzes kept me going for the entire course. Overall, I found this course useful and engaging.*"

"Reflection quiz helped me look back at what I have learnt; LbD activities made us engaged in learning; and the videos made the course interesting."

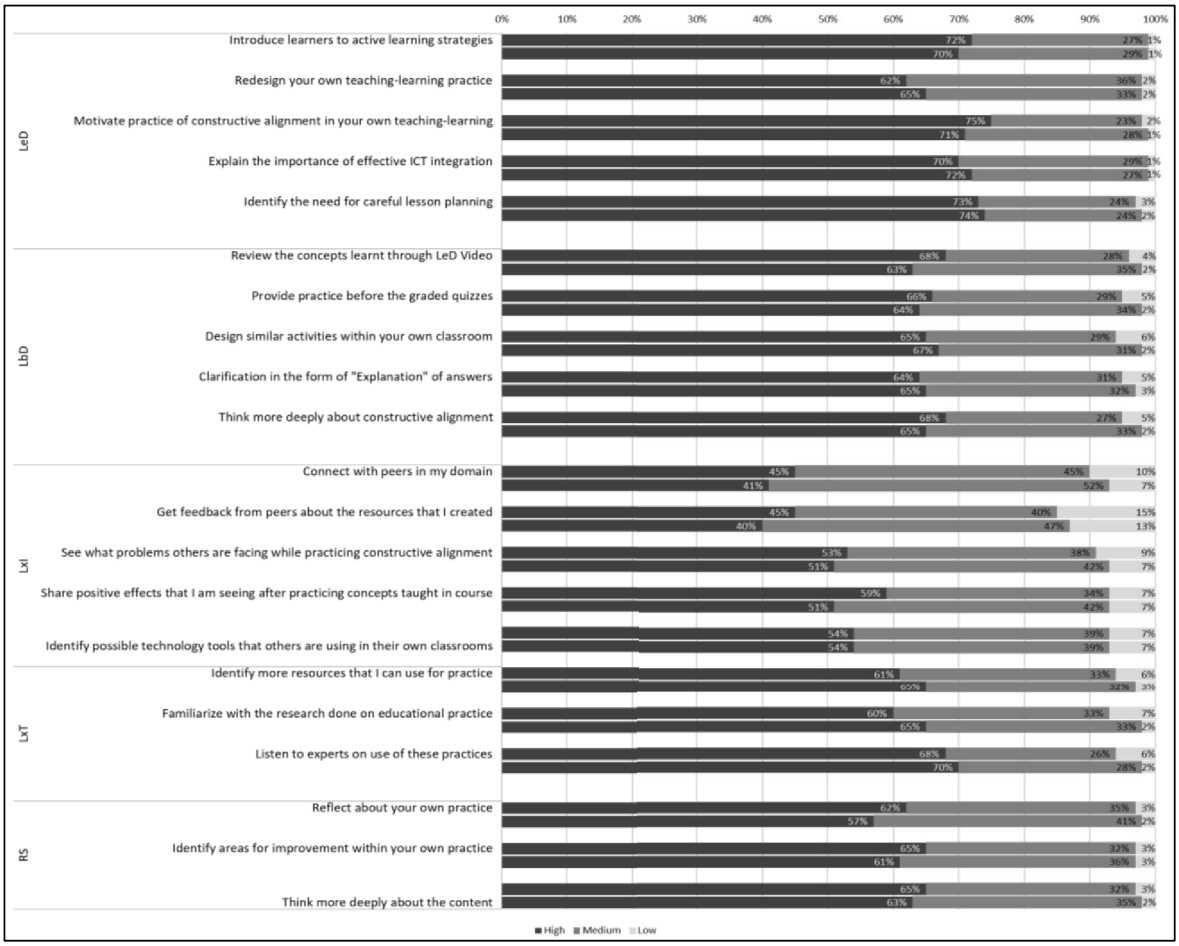

Figure 5. Perception results on the usefulness of different course elements in learning of specific tasks. For each question, the bars in pairs represent the results for the two course offerings. The upper and lower bar in the pair show results for T1 (n=245) and T2 (278), respectively.

"Lectures (LeDs), reflection spots and discussions (LxIs) helped in continued interest in learning, which is a very important factor of the learning process."

"The course was well-planned and well-organised, which made me persevere. All the activities including LeDs, LbDs, learning extension resources etc. are helpful in learning new things. I am thankful to all team members."

Active learning strategies: Responses (23%: T1; 30%: T2) regarding the learner-centric experience of teachers in the course, their satistaction with the content, and their intent to implement these learner-centred strategies in their classrooms, were pooled in this category.

"*This course helped me in learning new ways of teaching. It helps in improving active learning. It encourages the activity of learning by doing, which is more easy and useful for student.*"

Technology-enhanced teaching and learning practices: Teachers' responses (23%: T1; 21%: T2) regarding introduction to technology, explicit explanations of technological concepts, and benefits of learning effective integration of ICT tools in their teaching practices, were collated in this category.

"The usefulness of the course in improving the effective use of ICT in pedagogy, and its efficacy in delivering its objectives provided me an impetus in perseverance."

Professional Development: Responses (22%: T1; 16%: T2) in this category were in reference to the training of teachers to enhance their own professional knowledge and skills.

"*It was an enriching experience, and made me wiser. It has enhanced my level of confidence.*"

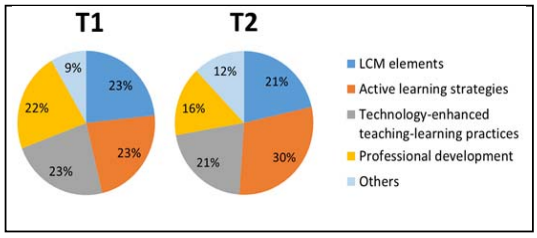

Figure 6. Frequency distribution of conceptions (including LCM elements) resulting in participants' perseverance in the course offerings, T1 (n=230) and T2 (n=278).

Others: There were some responses which did not fit in any of the above mentioned categories, and have thus been collated in this category. Some of these responses included deadlines, peer pressure, positive attitude, fear of failure etc.

VII. Discussion

We conducted a perception study of MOOC participants to gain insight into: 1) their learning of the MOOC content, that is, their perceptions towards ICT integration using learner-centric approaches, and 2) their experiences with the MOOC pedagogical format, that is, their perceived usefulness of the learner-centric elements within this MOOC for various purposes.

Quantitative results on teachers' perception of the course established the usefulness of the MOOC in three different aspects: 1) LCM elements or activities in the course pedagogy, 2) gains in content knowledge and skills, and 3) application of the acquired skills in their teaching practices. Regarding the usefulness of the LCM elements, majority of the teachers perceived all course elements to be useful. Specifically, we observed that LeDs and LbDs were perceived as most useful by the teachers in both the offerings (Fig. 4). This also corroborates to previous studies in online learning which emphasize on the role of learning by doing, and other active learning strategies in classroom teaching [8, 11]. Majority of the respondents reported to have gained highly from the course with respect to content knowledge and skills (Fig. 5). Participants not only learnt new instructional strategies but also came up with lesson plans to implement these strategies in their own classrooms. Regarding the application of these skills in classrooms, most teachers perceived the course to be useful in a variety of learning outcomes, and in redesigning their own teaching practices. They also intended to create a similar learning experience for their students. The consistency of results between the two offerings also provided confidence in the pedagogical features of the learner-centric MOOC.

To answer our second research question, the completion rates of the participants were determined after the end of the course. In online learning such as MOOCs, it has been observed that the completion rates are typically 10-12% [21]. There is a known funnel of participation in MOOCs, which occurs from the time of course awareness till the completion of the course [22]. In our LCM, we observed that completion rates were 14.9% and 16.1% for T1 and T2, respectively. However, considering active participants, the persistence rates were found to be 43.3% and 36.3% for T1 and T2, respectively. It was encouraging to observe such results considering that the participants of the study were in-service teachers, who completed the course, along with their daily teaching and academic responsibilities.

To gain more insight on the perception of participants, we performed an open-ended qualitative analysis, which also answers our third research question. As shown in Fig. 6, the participants reflected on four major factors which contributed towards their perseverance in the course. Explicit mention of participants regarding the LCM elements, as a reason for their perseverance in the MOOC, supports many literature studies focusing on the role of active learning in online education [8].

Participants also reported that well-explained concepts of ICT and learner-centric strategies, and their benefits for enhanced teaching-learning practices were other factors which led them to persevere. Since the expectation from the course is effective implementation of ICT tools in schools, it was encouraging to observe teachers' responses on their intentions to employ the learnings of the course in their respective domains. Some of the teachers' responses also implied that they have already commenced the implementation of these strategies in their classrooms, which is considered as an integral success of the course.

One limitation of our study is that our results are indicative and correlational, but not causal. However, effective learning with ICT has been reported to be dependent on good pedagogical design [23]. Our MOOC was based on a learner-centric pedagogical design, and the results show teachers' perceptions about specific elements of the pedagogical design.

Given the transactional distance in online learning, there is support for emphasizing on peer connect and peer learning, especially in MOOCs [24, 25]. In our study, the LxIs were explicitly mentioned by some teachers in the open-ended question, as a valuable platform for discussions and learning with peers. However, as observed in the quantitative analysis (Fig. 5), LxI showed comparatively lower response in getting feedback from peers and connecting with peers. This indicates that further research is needed in understanding the specific catalysts and inhibitors for increasing peer connect, peer feedback mechanism, and sustaining learner engagement in MOOC settings.

VIII. Summary and Conclusion

At present, most literature on MOOCs reflects strategic and design guidelines regarding the adoption of learner-centric approaches. Through our study, we contribute towards the application and evaluation of a learner-centric pedagogical design of a TPD MOOC, participated by thousands of teachers. The MOOC employed the LCM model comprising LeDs, LbDs, LxIs and LxTs to foster active participation and learner engagement. The pedagogical features were found to be successful in terms of high ratings of usefulness observed through participants' evaluation in increased understanding of the subject, their intent to future application of learnt strategies, their exclusively positive responses, and high rates of perseverance.

Reflecting on our results, learner-centric pedagogical design of the MOOC has played an important role in the success of our course. Some of the specific pedagogical practices employed in the MOOC included: 1) Providing points of reflection through reflection spots within LeDs, 2) Linking active LbD activities with participant's actual practice, and providing customized and constructive feedback, 3) Focused thread-based LxI forums requiring peer interactions, 4) Identifying specifc LxT resources addressing different subject areas, 5) Use of learner-centred strategies with available visualizations, 6) Well-constructed examples of learning outcomes from multiple domains, and 7) Providing detailed feedback in practice exercises and quizzes. The overall pedagogical approach of the LCM model, employed in the course, can further be explored by researchers to adapt the course design features in their online or classroom learning to improve students' engagement and learning outcomes.

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