Learn to Design (L2D): a TPD Program to Support Teachers in Adapting ICT Learning Materials to Their Local Context through Research-Based Strategies

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Abstract: Knowledge of ICT and ability to integrate technology effectively in one's teaching practice has gained enormous importance for today's teachers. In the last two decades a lot of quality teaching materials and repositories have been created worldwide. However, capacity building of teachers and improving teachers' learning design skills has not received as much attention. Hence teachers are not adequately prepared to use technology in their practice and integrate it with learner-centric pedagogical strategies. While a large amount of resources and teaching and learning materials are available for common use, these lack contextualization. There is a need for teachers to build the necessary knowledge and skills to adapt the materials for their context. In this paper we describe the design and implementation of a TPD program, *Learn to Design* for supporting teachers to design research-based strategies using learning materials available on the DIKSHA platform, a national initiative in India, and adapt them to their local context. The program design draws from the TPACK framework and includes hands-on activities focused on enhancing the ability and self-efficacy of teachers to integrate technology into their teaching. The TPD workshop has been implemented with ~300 participants who were in-service teachers from across different states in India. The study analyzes data from multiple sources. The findings show improvement in participants' self-perception and ability to effectively integrate technology, as well as high intention to implement such strategies in their own classroom. In *Learn to Design*, we have created the design and session plan to support teachers in effectively integrating content, pedagogy and technology in their own context.

Keywords: Teacher professional development, contextualization of learning materials, ICT integration, TPACK, Constructive alignment

1. Introduction

The affordances of information and communication technologies in teaching and learning provides a number of benefits and should be used to support student-centered learning. (Howland, Jonassen & Marra, 2012). However, inadequate teacher preparation to use technology and apply new educational strategies (Brown & Warschauer, 2006), as well as teachers' ideas and attitudes toward technology (Ertmer, 2005), have hampered meaningful integration of technology with successful pedagogical practices. Another issue to examine is the teacher's own view of the need for new technology training (Amhag, 2019). Teachers must not only have digital competence for their own professional practice, but they must also act as role models for their students when using digital technology in the classroom (Lund and Erikson 2016). However, achieving acceptable levels of digital proficiency is not without difficulties, (Gudmundsdottir and Hatlevik 2018). There are 3 types of barriers to effective ICT implementation - extrinsic, intrinsic factors and design thinking (Ertmer, 1999) . Researchers have argued that overcoming the extrinsic and intrinsic barriers is not enough . The third level barrier is the lack of design thinking, that is, instructors' ability to dynamically create knowledge and expertise in response to the pedagogical affordances of ICT (Tsai & Chai, 2012).

Realizing the potential of technology in education there are several ICT projects launched in India, to help and motivate learners. These include DIKSHA, Prerna, e-GyanKosh, NPTEL, e-PG

Pathshala, The National Literacy Mission, Sarva Shiksha Abhiyan (SSA) (Bist, 2007). However, the benefits of ICTs have not reached the expected level and maintaining the quality of education is one of the key challenges in India. Despite the resources like DIKSHA being available to the teachers, the implementation of the same is yet to be explored. An important gap is in the contextualization of these materials. Ultimately teachers have to teach with the same common set of materials in their own classes, for their target learners. Teachers' need to be able to take the commonly created materials and adapt them. Which means they need to build the necessary knowledge and skills to do this. Not sufficient attention has been given to capacity building of teachers or in improving teachers' learning design skills. In many developing countries, teacher professional development (TPD) programs need to be scaled so that ICT-based curricular materials can be effectively utilized. However, in teacher training programs different components are dealt with separately, due to which the technology, pedagogy and content area integration is a rare feature. Due to this, teachers were found to be weak in aligning the instructional activities and assessment for intended learning outcomes (i.e., they face some challenges in PCK). Thus, it is important to develop the TPACK knowledge of teachers to make the teaching and learning experience more meaningful. (Finger et al, 2015).

In this paper, our goal is to describe a workshop design *Learn to design* (L2D) and helping teachers implement research-based strategies using ICT based content, adapt it to their local context and enhance ease of use. The workshop design includes hands-on learning activities that focuses on enhancing the self-efficacy of teachers to integrate technology and practical adaptation of research based strategies into their teaching. Teachers can feel efficacious and in control of learning to teach with technology when their technology competency is improved. However, technology alone is not sufficient, pedagogical as well content knowledge is also crucial. The workshop activities are designed based on the TPACK framework (Mishra & Koehler, 2006), LCM model (Murthy et al, 2018) and constructive alignment (Biggs, 1996) to integrate technology, pedagogy and content. The two questions that are the focus of this study are as follows:
RQ 1. What are the effects of workshop training on participants' performance and perceived ability to design learning materials?
RQ 2. What are the effects of workshop training on participants' perception and their intention to use existing repositories of ICT materials?

2. Background and Related Work

Use of ICT helps in development of higher order thinking skills such as conceptual and procedural understanding, collaborating across time and place and real world problem-solving (Riess & Mischo, 2010). But the teachers are often unaware of ICT-enabled teaching methodology and effective integration strategies. A common issue is faced due to the teachers attitude and behaviour towards the use of ICT. Teachers' beliefs and attitudes towards the potentials of ICT in teaching and learning have been regarded as central conditions for successful implementation of new technologies. Even if a teacher has adequate resources, extensive digital instructional tools, and positive attitudes or strong ideas about technology integration, she/he may not be able to execute it successfully. (Dexter and Anderson, 2002, Ertmer et al., 1999, Newhouse, 2001). Another barrier that needs to be addressed for technology integration is the teachers' design thinking. Because the classroom environment and students are constantly changing, the teacher should use design thinking to reorganise or build learning materials and activities that adapt to the demands of diverse situations or groups of learners (Tsai and Chai, 2012).

Among the several ICT initiatives taken by the Govt of India DIKSHA Portal comprises curriculum aligned e-Learning content such as video lessons, assessments, worksheets and textbooks for all level students, teachers and even parents. It is a customizable platform currently being used by teachers (from both government and private institutions) across the nation. The platform offers various teacher training courses like Introduction to ICT, Integration of ICT in Teaching, Learning and Assessment and ICT tools. However, the synchronous interaction component is missing in these courses. This can be brought up by online workshops where teachers can interact with the instructor, perform simultaneous hands-on activities and receive real time feedback on the same. This helps in boosting the confidence and improving the self-efficacy of teachers that can be monitored. In order to facilitate this, we propose a workshop design (L2D) that can fulfil this gap.

3. Workshop Design

In order to provide training opportunities to teachers for effective implementation of ICT we have designed a workshop called *Learn to design(L2D)*. The workshop design includes hands-on learning activities that focuses on enhancing the self-efficacy of teachers to integrate technology into their teaching. Teachers can feel efficacious and in control of learning to teach with technology when their technology competency is improved. However, technology alone is not sufficient and pedagogical as well as content knowledge is also crucial. The workshop activities are designed in such a way that they integrate technology, pedagogy and content. Table 1 describes the learning activities conducted in the workshop and their desired learning outcomes. In the activities for Day 1 of the workshop teachers were asked to choose a topic of their own choice for writing learning outcomes and respective assessment questions of different levels. For Day 2 teachers chose a particular video suitable for the previously chosen topic and edited it by adding reflection spot questions using a video editing software to make it suitable for their own context.

Table 1. *Session Plan and Outcomes of the Workshop*

Day 1- Synchronous mode			
Session title	Outcome (participants will be able to…..)	Activities	TPACK
1.1 Learning outcome why? What? & How?	Explain why learning objective is needed Identify valid learning objective	Writing learning outcomes	PK
1.2 Introduction to constructive alignment 1.3 Hands-on guided activity to write learning outcomes of different bloom's levels	Explain what is constructive alignment and why constructive alignment is needed. Classify the assessment questions as per Bloom's taxonomy. Generate questions for different levels of Bloom's taxonomy. Align the assessment questions to their respective learning objectives.	Writing Assessment questions of Recall and understand level Apply and analyze level Evaluate and create level	PCK
Day 2 - Synchronous mode			
2.1 Introduction to LeD 2.2 Importance of Reflection spot 2.3 Hands on session on reflection spot insertion through technology tools (H5P, Vizia)	Explain components of LeD. Identify pause points in learning dialogue. Use of technology tools to chunk content and insert reflection spots. Create own learner centric learning dialogue in their context	Writing reflection spot questions along with feedback and timestamp.	TPACK

4. Implementation

We conducted 2 pilot workshops prior to doing the main workshop. The purpose of these pilots was to understand what components of the workshop need modifications. Due to the COVID-19 pandemic the workshops were conducted as synchronous online sessions spread over 2 days. The platform used for the workshop was Google meet. Workshop 1 was conducted with 15 in-service teacher participants from Maharashtra. In workshop 1 it was observed that the modules related to reflection spot activities had lower scores compared to the other activities with 33.3% participants scoring in a range that needs further improvement. Taking cues from this experience, we worked on the refinement of this module. With more time spent on the demonstration of the tool followed by hands-on activity. With these

changes implemented, we conducted a second workshop with 27 in-service teacher participants from Maharashtra. We witnessed a positive outcome with the majority of participants performing well (50% scored valuable while 44.4% scored exemplar on a 3-point scale). With these insights from pilot workshop 1 and 2, a pre-workshop registration form was floated among the teacher groups in different states across the country. Total 308 participants participated in the workshop out of which 262 participants have been considered for data analysis in view of completeness of data available. We used Cisco Webex platform for conducting the workshop as it supports a large number of participants as compared to other video conferencing platforms available. It also provides a dial in option for participants to circumvent the internet bandwidth issue. Live synchronous sessions were planned for the duration of 2-2.5 hours on each day.

5. Methodology

We consider the sample of 262 participants who responded to the end of session survey and participated in the writing learning outcomes and assessment questions of different cognitive levels. There were a total of 9 data sources used for data collection. Pre-registration survey, pre-test, learning outcomes test, recall and understand level test, apply and analyze level test, evaluate and create level test, survey questionnaire on self-perception of constructive alignment and their intention to apply learning, reflection spot and feedback test and survey questionnaire on their self-perception on technology. The purpose of the pre-registration survey was to understand participants' familiarity with ICT and DIKSHA. A post-workshop survey questionnaire was used to capture the participant perceptions about the usefulness of this workshop, their engagement with the workshop modules, their perception about the use of technology and DIKSHA portal, and the pedagogical design of the workshop. The end of training survey for evaluating participant perception has been created and validated by the research team while the technology competence survey has been adapted from a standard instrument (Milman, Kortecamp & Peters, 2007). Participants' performance in the writing learning outcomes and assessment questions were evaluated on the basis of its specificity, measurability and use of appropriate action verbs. A 3-point scale rubric (1-potential to improve, 2-valuable, 3-exemplary) was used for evaluation. The reflection spots added by the participants were evaluated based on the chunking of content, suitability of the question and feedback provided for the learners.

6. Results

The survey results show that overall, there is a high perception of the training content, learning within the training and intention to apply among the participants. These changes in their perception are promising when compared to the pre-workshop data collected. The pre-workshop data shows that most of the participants (93.89%) were aware of the DIKSHA platform and 29% of them were regular users of DIKSHA. It was observed that 67.55% of them were restricted to the use of DIKSHA for training courses and 16.41% for content through either textbook QR code or mobile app. Only 9.16 % of the participants were making use of lesson plans provided on DIKSHA. Regarding the suitability of content available on DIKSHA, 19.46 % of the participants think that it requires certain modifications to make it suitable for their context. The pre-test results indicate that only 13.6% of the participants were able to identify valid learning outcomes and 35 % were able to identify assessment questions at different levels of Bloom's taxonomy from the given set of choices. The post workshop results show that participants were not only able to identify but also write valid learning outcomes and assessment questions. Participants' performance in the workshop learning activities on a 3-point scale suggest that 61.5% (161 out of 262) of the participants performed exemplary in writing learning outcomes while 76.7% (201 out of 262) were able to write exemplary assessment questions. Their performance in reflection spot activities suggest that 54.3 % (140 out of 262) of the participants have exemplary performance while 25.6% (66 out of 262) have valuable and 20.2 % potential to improve. Participants' perception of constructive alignment shows that ~95 % of them perceived to be confident about executing the constructive alignment between the learning outcomes and their corresponding assessment questions. The perception of participants on use of technology shows that ~40 % of the participants perceived

themselves as capable of finding suitable video resources, using available resources for planning classroom activities, modifying the content as per the requirements and making use of tools for adding interactivity to the content on their own while ~31 % of them perceived that they can teach this to others. This change in perception also reflects in their intention to apply the learning from the workshop into practice. Intention to use the DIKSHA portal for lesson planning witnessed a significant rise with 91.2 % (Strongly Agree = 35.1%, Agree = 56.1%) participants intending to use DIKSHA.

7. Discussion

The effects of the workshop on participants' performance and perceived ability to design learning materials was evident from struggling to identify valid learning outcomes in the pre-test to writing exemplary learning outcomes in the learning activities. This implies that workshop activities contributed to their ability to design learning outcomes. This was also evident in the quality of assessment questions produced by the participants and their self-perceptions of the ability in terms of the constructive alignment. Participants designed assessments at different cognitive levels considering the diversity of their learners. There was clear alignment between the learning outcomes defined and the corresponding assessment questions designed for a particular topic.

For the effects of the workshop on participants' intention to use repositories of ICT materials we found that the workshop design helped in bringing a shift in attitude towards the use of DIKSHA, which is evident in their intention to use DIKSHA for activities such as lesson planning and structuring class activities. Participants perceived that they will be able to adapt and modify the available content to make it suitable for their context. Their ability to modify existing content was demonstrated in their artifacts produced in the form of interactive videos.

The study limitations include the short duration of the workshop (2-2.5 hours/day). We acknowledge that some of the activities may require more time to be spent for acquiring efficiency. For example participants struggled in writing assessment questions at higher levels of the bloom's taxonomy as compared to the lower levels. ~25% of the participants perceived that they need some assistance in using the technology. Spending some more time on the workshop learning activities may help to address these limitations. Due to time constraint the delayed post-test remains to be conducted and concluded. Thus we do not have any data about actual implementation of the learnings from the workshop in the classroom. We plan to conduct a delayed post-test with a subset of the participants to draw inferences about the impact of workshop learnings on classroom implementation.

The key contribution of our work is that we have provided a tested workshop design along with a detailed session plan and set of activities designed and curated for providing hands-on experience in online mode. This might be useful for teacher-trainers and educators, researchers working on teacher professional development . The workshop design can be replicated with some modifications as per the needs and context. The activities and tools have been explored to ensure a low entry barrier for the participants.

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