Pedagogy-based Technology (PBT): A Framework for Designing Online Professional Development Platforms

Gurjot S. Sidhu[1], Subir Shukla[2]

Ignus Pahal

Abstract

Online professional development (OPD) promises the efficiency of scale at low-cost, the effectiveness of asynchronous learning and the something else of something else. In this regard the crucial role played by technology is often undermined by its ineffective implementation - something that we witnessed a lot of in the education system's migration to the online realm owing to the Covid-19 pandemic.

In this paper we put forward a framework that combines contemporary constructivist understanding of pedagogy with principles of technology design. This pedagogy-based technology (PBT) framework is intended to facilitate the development of a learning platform that synergises novelty and usability to maximise effectiveness. To aid this process we posit an analytical effectiveness equation that draws on the variables in the design process. To illustrate the framework in action, we provide examples from our experience of running OPD programmes during the pandemic with teachers, supportive supervisors and resource persons in the states of Rajasthan and Uttar Pradesh.

Following the method suggested by way of the framework should assist stakeholders in the state and civil society to develop robust and sustainable learning platforms that: build on constructivist pedagogy; deliver a high quality learning experience to the participants; generate learning data that feeds back into improving the system; and, optimise the course development process.

[1] gurjot@ignus-erg.org, +91 8448972072, Member, Group Ignus, with significant contributions from Deepti Srivastava, Surendra P. Singh, Tushar Tamhane, Shubhangi Bhide, Manisha Chaudhry and Mukesh Aggarwal

[2] subir@ignus-erg.org, +91 9910307993, Principal Coordinator, Group Ignus

Introduction

In-service professional development in the education sector has seen a widening scope both in terms of the content and the medium (Selvaraj, Alagukanna, & Suganya, 2015). Enhancing the relevance and quality of pre- and in-service teacher education has been one of the key issues identified in Indian policy documents (NCTE, 1998) (MHRD, 1968) (MHRD, 1986/92) (MHRD, 2020). Improving the effectiveness of training has been a prime focus of research and the linkages between teacher performance and student learning have been emphatically made (Guskey, 1985) (Jagannathan, 2000) (Colclough & De, 2010) (Yadav, 2011) (Rajput & Walia, 2001) (Kumar, Priyam, & Saxena, 2001).

The thrust towards online professional development (OPD) was amplified when the NCERT led the way by taking its flagship NISHTHA training programme (NCERT, 2019) online during the COVID-19 pandemic (NCERT, 2020). The pandemic manifested a situation where stakeholders engaged in a variety of experiments to meet the needs of professional development. In recent years technology has been used in various ways such as using WhatsApp groups for discussion, Zoom conferences for synchronous communication or Google Forms for feedback surveys. Consequently efforts have been made to optimise the confluence of technology and professional development (Sidhu & Shukla, 2020).

Connecting with the teacher's 'local knowledge' (Dyer, 2004) and emphasising engagement in asynchronous learning settings (Peters, 2011) (Ferguson, 2015) is vital for an effective training. An unfortunate reality of OPD has been that most efforts have been trying to recreate the facets of offline training in an online realm without challenging the defaults. Thus, traditionally online trainings are designed per the asynchronous video lecture format popularised by MOOCs in the last decade. Where video is not the primary mode of dissemination, rich-text is presented often in the form of PDFs. Assignments and MCQ quizzes usually form the assessments. While such platforms are pervasive, their pitfalls are similar to those of a classroom - low engagement, driven by assessment (or certification) and context-agnostic.

Often it is difficult to make modifications in an existing tech platform owing to its size. This serves as a double-edged sword as though such platforms can be quickly utilised and hold familiarity with the users, context-specific features are hard to build. Thus, *the pitfalls of the medium often have to be accommodated by the message.* To drive the point home, an analogy

can be made with a textbook. Most tech-based learning platforms in practice give the impression of a textbook with over 1500 pages, faded ink and a few cut out portions (usually images). It is apparent that such a textbook would have limited pedagogical utility no matter how well-constructed the text is. For any reasonable learning effort, technology has to serve the purpose of learning and not the other way round.

A year into working in online-only mode, it would be prudent to review our learnings and to find ways of reimagining OPD utilising the pros of technology. This raises important questions: What should be the qualities of a learning platform that is pedagogically sound and maximises effectiveness? How can such a platform be developed in the setting of the present-day Indian education sector?

In this paper we present a framework based on our experience in developing and running OPD courses for teachers, supportive supervisors and resource persons. Our work builds on our understanding of constructivist pedagogy inspired by NCF 2005 and our efforts to introduce NCERT books to elementary teachers in Rajasthan. We believe the learning synthesised into this paper will be increasingly relevant for state departments of education and NGO partners in the coming years.

In the first part, we start by discussing the linkages between constructivist pedagogy and good technology design. By recognising the similarities between the two, we introduce the pedagogy-based technology (PBT) framework and its foundational principles. We further describe the design process and introduce the Effectiveness Equation. In the second part, we give suggestions for applying the PBT framework and illustrate its application with the help of two OPD programmes run by us in the states of Uttar Pradesh and Rajasthan.

Part 1: The PBT Framework

Every medium has a default pedagogical structure attached to it. A lecture hall with multiple blackboards, a raised platform and student clickers assumes a certain pedagogy. Similarly, all technology mediums come with an assumed pedagogy, which mostly is not in line with constructivism. It is apparent that the boundaries between conventional in-person pedagogy and technology design have blurred and the two have fused together. Thus, we base the theoretical underpinnings of the pedagogy-based technology framework on the contemporary understanding of constructivist pedagogy (NCERT, 2005). Rather unsurprisingly the

principles of good technology design are closely related to that of good pedagogical practice (Unger, 2012) (Benyon, 2014).

The PBT framework is a three-step process –

1. Recognising the variables
2. Maximising the effectiveness
3. Implementing the choices

We elaborate on these steps in the following sections. First, we present the foundational principles of the PBT framework –

- **Designing for the user's context and needs.** Connecting with the learner's experiences is fundamental to both good teaching and user interaction.
- **Maintaining usability.** While attracting users is necessary, keeping them engaged is more important.
- **Friction-less navigation.** Incrementally increasing the cognitive load or taking from known to unknown is a well-established teaching strategy that technology needs to implement.
- **Opportunities for reflection.** For learning to set in, the learners have to reflect upon their experiences. This is most crucially missing in tech design.
- **Small wins.** Essential strategy for keeping the learner hooked towards accomplishing a bigger task.

The PBT framework gives a structure for the design process that allows technology designers to take a comprehensive approach and create a platform that reflects a deliberately thought out version of constructivist pedagogy. This allows decisions to be made with a coherent rationale and helps avoid sunk-cost and availability bias. It is worth noting at the offset that the decisions arrived at using the framework are not sacrosanct and should be expected to change as the requirements of the system change.

I. Recognising the variables

When designing technology for any purpose, let alone for learning, there are a set of variables at play. These variables can be categorised under different heads –

- **Hardware:** Will the users access the course on a mobile device or a computer? What type of processing capabilities does a typical user's device have? What type of internet connection will the user have available?
- **Duration:** Is the user expected to finish the course in a few hours, days, weeks or months? How much time is the user expected to spend in a single sitting?
- **Interaction type:** Will coursework take place synchronously or asynchronously? Will the users interact via quizzes or assignments? With what frequency and in what detail will the user interaction occur? Will the users interact in a dedicated forum?
- **Feedback mechanism:** Will the users get access to their learning data? What actions does the state intend to take with user data?
- **System requirements:** What are the MIS expectations of the state? Is the learning system expected to tie in with an existing state portal? How is the course expected to scale?
- **Prior experience and inertia:** What type of courses have the users taken digitally before? How enthusiastic are the users for such OPD courses?
- **Potential edge cases:** Will the course be impacted if some unwanted actors gain access to it? How quickly can the course be scaled up or taken to a new geography?
- **Resources:** How much time, fiscal and human resources are available for development?

At this stage the intention is to explore possibilities, so even components that are a priori known to be fixed should be treated as variables. The interlinkages between these variables becomes apparent when we start to fix them. For example, if we decide that the coursework will take place synchronously, a high speed internet connection would likely be necessary and this sets constraints on the type of interactions possible and the expected time spend.

II. Maximising the effectiveness

The end-objective of any such effort is maximising effectiveness. Under the PBT framework we break effectiveness down into two complementary subcomponents - novelty and usability. Novelty attracts users, usability keeps them engaged.

To formalise the problem, we take an analytical approach. Consider that the interaction of the variables above yields an effectiveness equation –

$$E(N,U) = N(n_1, n_2, \ldots) \, x \, U(u_1, u_2, \ldots)$$

Where, n_1, n_2, ... are variables that determine the novelty and u_1, u_2, ... determine the usability of the technology platform. We posit that the variables can have both a direct and inverse relationship between them. As an example, a synchronous OPD course could have high novelty $N(n)$ but low usability $U(u)$ because of the high-speed internet requirement. Thus, for all practical purposes we have to arrive at an equilibrium between novelty and usability in order to maximise the equation. At this moment, we do not attribute any score (numerical or otherwise) to the variables since the components at play are highly subjective.

III. Implementing the choices

When maximising the effectiveness equation we are implicitly making technology choices. These choices set up the core components of the learning system –

- **Hardware / Hosting**
  What backend technology stack would suit the scaling requirements? For short deadlines, can an existing system be modified for the purpose? Eg. Moodle (self-hosted); LearnDash (WordPress); SQL vs NoSQL database; shared hosting vs dedicated hosting
- **CMS**
  How will the content writers upload the content? Eg. WYSIWYG editor like WordPress/Drupal; Providing a text document to an operator
- **UI / UX**
  Will the website be designed from scratch? Can an existing theme be modified? Will the theme be suitable for the user's devices? Eg. Using LMS-provided themes; Modifying a CMS-provided theme; Building from scratch
- **Authentication**
  Do users create their unique IDs or is the auth service linked to an existing ID? Or is the content accessible without auth? Eg. Mobile OTP based auth; Linking with staff ID
- **Data MIS**
  What actions are intended with the user data and thus what type of data is required?

How will the data be recorded and shared? Can an existing service be used? Eg. Using WordPress plugins for reports; Organising raw data

Part 2: Applying the Framework

Clarity on part of the state department significantly benefits the process and reduces the implementation of tech for tech's sake. Though it is often not within the capacity of the state to develop such a system in-house and external partners are roped in. Unfortunately, in most situations an off-the-shelf solution is preferred which isn't always the most suitable. With the PBT framework, state functionaries can ask partner agencies to create a robust and sustainable solution that defaults to pedagogically appropriate features. Since such an effort would come with a design rationale, future modifications are inherently supported by reason.

In practice, this would require a collaboration between pedagogues and technologists. At Ignus Pahal we had the opportunity to exercise this by running an in-house LMS[3] for the state of Uttar Pradesh and by working with UN OICT for running an LMS[4] for the state of Rajasthan. The projects were supported by UNICEF-UP and UNICEF-RJ respectively.

The two projects gave us the experience of working on either ends of the design spectrum as described in the Table 1. While designing the content for the UP project, we were free to experiment with various styles as the tech requirements were being handled in-house. In contrast, a few constraints were laid on the content writing aspect of the Rajasthan project owing to the nature of LMS being used. Both designs were developed based on the requirements of the individual context and have learnt significantly from user feedback. Detailed accounts of these experiences are presented in a sister publication by our colleagues.

Location	**Uttar Pradesh**	**Rajasthan**
Project Description	Professional Development Course for UP State Resource Group; Aimed at supportive supervision	Professional Development Course for Upper Primary Teachers; Aimed at constructivist pedagogy and usage of NCERT textbooks
Number of Participants	225	> 1,00,000

[3] Developed with the help of Sputznik: https://sputznik.com
[4] Developed and run by UN OICT: https://unilearn.org.in/

Type of Participants	State resource persons	Middle school teachers, supportive supervisors
Hosting	Self-hosted at Ignus Academy	By UN OICT at Unilearn
CMS / LMS	LearnDash Content uploaded using WordPress	Moodle Content provided in Word docs, uploaded to system by Unilearn team
Authentication	User-created ID	System-generated ID linked with NIC staff ID
User Interface	Modern; Mobile-first; Custom theme	Classic; Desktop-first; Modified Moodle theme
Data MIS	User Insights plugin	Raw data

Table 1: Tech design description of projects in Uttar Pradesh and Rajasthan

Conclusion

The PBT framework should be considered a work in progress. implications of it are heavily reliant on the context in which the supposed learning platform is being developed. The framework saw tremendous post-facto improvement as we learnt from our experiences in Uttar Pradesh and Rajasthan. While its broader principles stand firm and the present form is what we would start our next assignment with, we believe that the framework would see further improvements from the experiences of our own and those of our colleagues. Thus, we present it to colleagues in government, civil society and tech to critique and improve upon.

In future, we expect to improve robustness by way of adding scores to the variables, thus allowing for analytical solutions to the effectiveness equation. Given the pervasive nature of technology in education today, it would be prudent to have an EdTech Framework (ETF) akin to the National Curriculum Framework. The ETF can guide state departments in utilising technology interventions in their context while ensuring that any learning system used meets certain minimal pedagogical standards.

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