

Developing a Taxonomy of Edtech Products for Teachers: An Integrated Analysis from Research Literature and Product Landscape

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Abstract: The COVID-19 pandemic has caused teachers across India to use Edtech products in teaching. But teachers face multiple challenges, ranging from selecting appropriate Edtech tools to developing their own teaching practice for teaching with Edtech. The currently available taxonomies and landscapes of Edtech products either address student-facing products or focus on a niche category of teacher-facing products like assessment tools or open-source tools. In this paper, we present a taxonomy of teacher-facing Edtech products that contains a hierarchy of three levels with learner-centric activity tools and teacher professional development forming the base layer. Each category further spins off into multiple sub-categories based on various teacher objectives like products for conducting learner-centric activities, generating summative assessments, or developing their teaching competencies. This taxonomy emerged from a systematic literature review and a field-driven affordance analysis of a representative set of eighty products. Our analysis showed that the product landscape was skewed towards learner-centric activity tools (70% of the 80 Edtech products analyzed), revealing the need for more products that support teachers' professional development (TPD). This taxonomy informs teachers about the products available under different Edtech categories. It also includes an affordance analysis that provides additional information about the affordances typical to that particular sub-category.

Keywords: Taxonomy, technological tools, Edtech products for teachers, app for teachers

1. Introduction and Background

The education system in India has witnessed a paradigm shift as a consequence of the Covid-19 pandemic. All educational institutions are attempting to become proficient in online teaching and learning using Edtech products. EdTech enables teachers to plan and deliver lessons efficiently (Soalabla, 2020), conduct formative and summative assessments (Prasanthi & Vas, 2019), and organise collaborative activities (Lomas et al., 2008). In addition, they can provide a collaborative platform for teachers to develop their teaching practice (Ovcharuk et al., 2020). India has been witnessing an increasing demand for Edtech products (KPMG report, 2017) which has now skyrocketed due to the pandemic (EY-Parthenon, 2021) and a corresponding deluge of various Edtech products. Such a scenario makes it difficult for teachers to make an informed choice of EdTech tools that will effectively address their teaching and learning objectives. The challenge of tool selection is further compounded by inadequate technical training on teaching with Edtech, technical, administrative and peer support constraints (Johnson et al., 2016; Ghavifekr et al, 2016). Therefore, to make teachers more proficient in selecting appropriate tools, they must be made aware of the affordances of various Edtech products and how they map to their objectives. The availability of a well-defined taxonomy of Edtech products in India will enable them to make an informed decision and also identify gaps in product categories that need to be plugged in to provide comprehensive support to our teachers.

We explored and analyzed multiple existing taxonomies and landscape reports of Edtech products for India. The classifications in these reports varied from focusing on specific categories of Edtech products like open-source tools, assessment tools, collaboration tools for teachers, to a landscape of student-facing tools. Apart from these, there are landscape reports on the Government of

India initiatives to support the digitization of teaching-learning like online teacher training or student apps. In this section, we provide details of such existing reports.

Prasanthi and Vas (2019) delved depth-first into Assessment tools to propose eight categories i.e. diagnostic, formative, summative, norm-referenced, criterion-referenced, interim/benchmark, confirmative and ipsative assessment and provided examples of twenty formative assessment (FA) tools. Donahoe et al. (2019) classified Edtech tools into four categories based on teacher needs: active strategies, Instruction, Assessment, and Feedback. Active strategies refer to student engagements through gaming, polling, and brainstorming, Instruction refers to students' learning enhancement, Assessment refers to assessing students informally and formally and Feedback refers to providing real-time instant feedback to students. Pilli and Admiraal (2016) developed a taxonomy for massive open online courses (MOOCs). Vidya (2014) categorised forty-eight teacher tools into three broad categories: Learn-teach-learn, online learning, and subject-specific tools. The Learn-teach-learn has three subcategories: Mindtools, Resource management tools, and creativity tools, online learning has two subcategories: Learning management tools and Google Apps for education and the subject-specific tools have three subcategories: Expanding the knowledge base, Experiential learning, and Simulation.

The India Report-Digital Education (2020) revealed that India's central and various state governments had developed online capacity building programs for teachers through web and android applications. Nevertheless, the number of products for teachers' professional progressiveness is fewer than student learning, and the design of these Edtech products reflects a fundamental lack of understanding of the needs of teachers (DataLabs by Inc42, 2020). Teachers need a single taxonomy to get all the information about Edtech products to suit their various objectives like the plan & deliver lessons efficiently, conduct formative & summative assessments and, organise collaborative activities. The existing taxonomies and landscape hardly focus on Edtech products for teachers, and the few that do exist are majorly depth-first focusing on niche products. The breadth-first macro-level view of Edtech products mapped to teacher objectives but does not include an overview of teacher training products. We are doing a breadth-first also of EdTech products mapped to teacher needs but includes TPD products. A lot of Edtech products help the teachers in teaching effectively. All these tools will be meaningless to the teacher if a teacher does not know how to integrate technology into the classroom. So training platforms TPD also come into the purview of Edtech products taxonomy. This taxonomy is scoped to teacher needs related to effective teaching with Edtech. We included those categories that have existing products with an Indian presence and are easily accessible for teachers.

2. Methodology

A two-pronged approach was adopted to build the taxonomy - literature-driven and field-driven, to boost its relevance and usability. The literature-driven approach involved a systematic review of research articles and landscape reports on different types of EdTech products in India (Figure 1). The Preferred Reporting Items for Systematic Reviews and Meta-analysis for Protocol (PRISMA-P) 2015 was followed. Research databases like IEEE, Google scholar, research gate and science direct were surveyed for papers focused on teacher-facing products including technology-enhanced TPD. Landscape reports, focused on India, were also reviewed. The search keywords used were Edtech, Taxonomy of Edtech, digital tools in India, tools for teachers, technology-enhanced/online TPD. The scope of this review is limited to the past 8 years i.e., 2014 to 2021.

An affordance-level analysis of around 80 Edtech products, both commercial and academic, was done in order to map them to various teacher objectives. Commercial products were included based on their consumer base, google play store rating and accessibility to teachers in India. Simultaneously, academic tools were also considered if they had effectiveness reports. Affordances were identified for each product and then grouped together based on the specific teacher objective they were addressing. Those Edtech products were excluded whose a) primary role was to provide administrative and infrastructural support to teachers like classroom management tools or b) demands a high level of technical expertise from teachers like content creation tools.

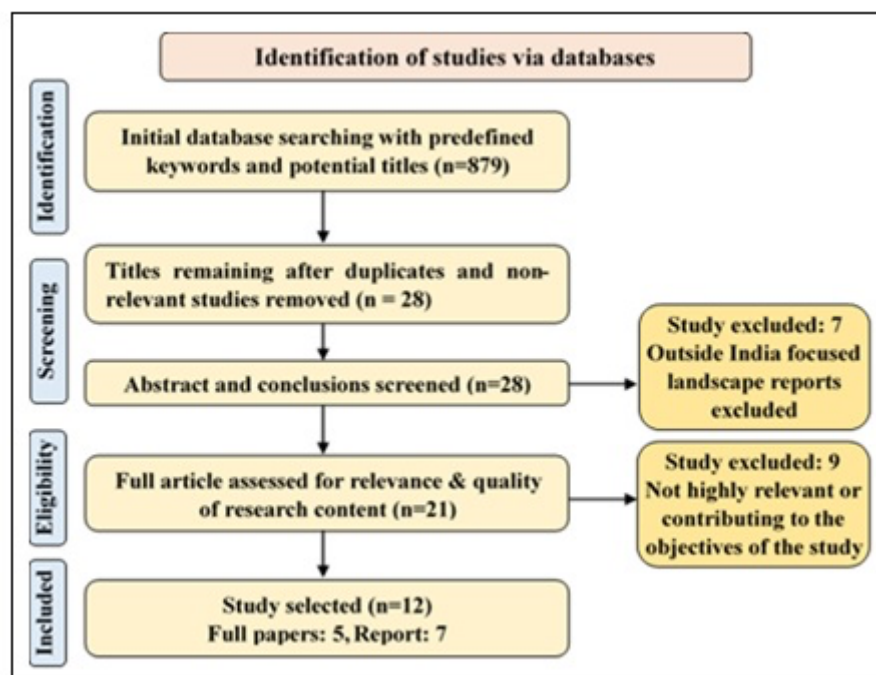


Figure 1. Flow diagram to depict the systematic review process (Design source: Page et al, 2020).

3. Results

A three-level taxonomy of Edtech products for teachers emerged from the literature review, landscape reports analysis and 80 Edtech products for teachers (Fig. 2). The two foundational categories were Learner-centric activity tools and Teacher Professional Development. Analysis of the taxonomy showed the majority of sampled Edtech products are learner-centric activity tools while only 30% are targeted at teacher professional development.

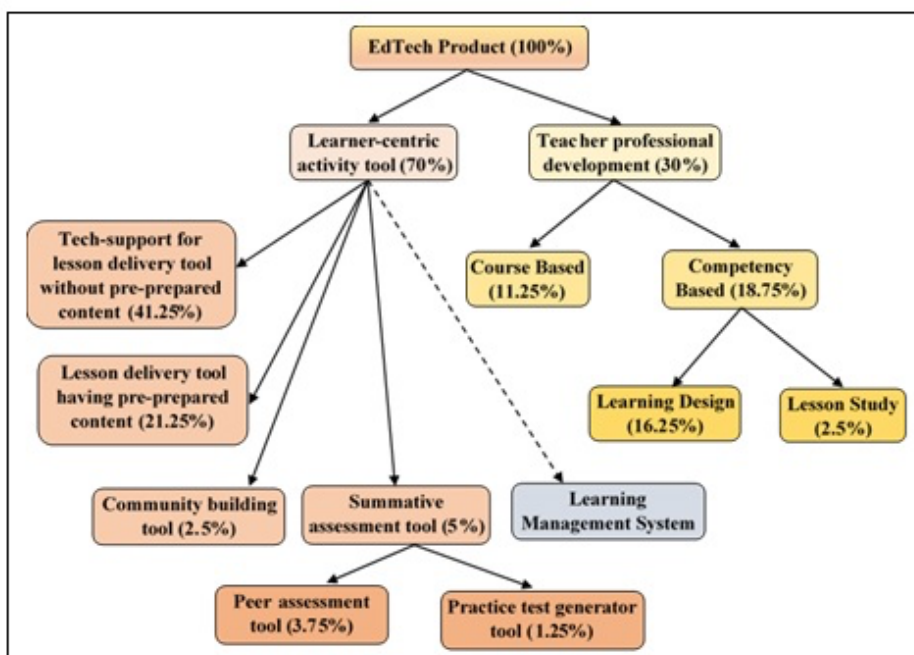


Figure 2. Taxonomy of Edtech products for teachers.

3.1 Learner-centric activity tools: These are tools that the teacher can use to conduct learner-centric activities with the students like conducting formative assessment activities in formal educational settings. Its five subcategories are described in Table 1 in terms of their teaching objective, primary affordances generic to the sub-category and product examples.

Table 1. *Taxonomy of learner-centric activity products for teachers*

Level 1 - A. Learner-Centric Activity Product
<p><i>Category I: Tech support for Lesson delivery tool without pre-prepared content</i> Tools that support lesson delivery but do not provide pre-prepared content and/or question banks to teachers. The teaching objective is to make learning engaging and interactive.</p>
<p><i>Affordances:</i> Different question templates, polling options, facilitate collaborative learning</p>
<p><i>Examples:</i> Mentimeter, Padlet, H5P, Vizia, Formative, Poll Everywhere, Spiral, Cmap, Formsite</p>
<p><i>Category II: Lesson delivery tool having pre-prepared content</i> Tools that provide interactive multimedia content with provision for teachers to add their own questions and constructive feedback, contains bank of curated lessons for teachers. The teaching objective is to make learning interactive with multimedia lessons and formative assessments.</p>
<p><i>Affordances:</i> Curated, interactive multimedia content, customizable with actionable dashboard</p>
<p><i>Examples:</i> Edpuzzle, Nearpod, Kahoot, Peardeck, Quizizz, Socrative, Edulastic, Plickers, Quia</p>
<p><i>Category III: Community-building tool</i> These are tools for online discussions that promote peer learning to accept different approaches to professional practice. A typical activity involves the teacher posing a focus question on a resource shared and students responding to the focus question and commenting on each other's comments. Teachers can close the learning loop by commenting on the discussion thread. The teaching objective is to facilitate engagement and social learning, building a community for teachers to share best practices.</p>
<p><i>Affordances:</i> Discussion forum - support video/text comment, support to record and upload own videos/audio and upload, customizable curated content and feedback, analytics like total view</p>
<p><i>Examples:</i> Flipgrid, TED-Ed</p>
<p><i>Category IV: Summative assessment tool</i> Tools that allow the creation of summative assessment/practise test papers and also facilitates teachers to track, monitor, and grade individual learners' performance. It has two sub-categories.</p>
<p><i>Sub Category—Peer assessment tool:</i> It is an assessment tool that allows learners to grade the academic work submitted by their peers using rubrics. Both peers and teachers can be part of the assessment process. The teaching objective is to conduct an asynchronous summative assessment.</p>
<p><i>Affordances:</i> Peer grading, customized feedback, Collaboration, rubric library/ scoring rubrics</p>
<p><i>Examples:</i> Peergrade, Crowdgrader, Floop</p>

<i>Sub Category—Practice test generator tool:</i> These tools allow teachers to create a subjective or objective question paper from the available question bank resources. The teaching objective is to create worksheets for learners to practice and engage them in a fun way to revise topics.
<i>Affordances:</i> Question bank, customized feedback, set assignment with pre-prepared worksheets with custom/quick practise worksheets, actionable dashboard, provide certificates and leaderboard
<i>Examples:</i> TabbieMath
<i>Category V: Learning Management System (LMS)</i> Aids creation, management and delivery of course material. It integrates the functionalities offered by the single-function tech-support tools mentioned above. A deeper analysis of the quality of integration of these diverse functionalities is needed (future work).

3.2 Teacher Professional Development: Enables teachers to develop their teaching practice through learning by doing activities. Table 2 presents its two subcategories.

Table 2. *Taxonomy of teacher professional development products for teachers*

Level 1 Category - B. Teacher Professional Development Products
<i>Category I: Course-based</i> These tools refer to repositories of professional development courses for teachers to acquire pedagogical knowledge and skills. The teaching objective is to gain mastery over domain knowledge, pedagogical strategies & EdTech integration.
<i>Affordances:</i> Provides training videos, dashboard analytics, discussion forum, certification
<i>Examples:</i> Diksha, SWAYAM, The Teacher App, Chalklit, Coursera, Delhi SCERT INSET
<i>Category II: Competency-based</i> These are products that teachers can use to either practice their newly learned skills or develop their professional competencies. The majority of these tools are research output by academic groups. Tools under this category are divided into two subcategories, as explained below.
<i>Sub Category— Learning Design:</i> Teachers can learn by doing how to design learner-centric lesson plans for effective integration of technology.
<i>Affordances:</i> Guidelines for decision making, lesson plan templates, bank of best-practice lesson plans to refer
<i>Examples:</i> CuVIS, Learning Designer, WebCollage, CADMOS, CompendiumLD, Cloudworks
<i>Sub Category—Lesson Study:</i> Teachers can learn by doing lesson studies to develop their reflective practitioner skills when implementing their learning designs.
<i>Affordances:</i> Video uploads of in-class teaching, discussion forum, reflection prompts, provision to note down reflections & iteratively improve lesson plan implementation
<i>Examples:</i> Edthema, Online lesson study platform (OLSP)

5. Conclusion

Edtech products available in India, mainly focus on facilitating and improving students' learning rather than enhancing teachers' professional development and teaching practice. This paper presents a taxonomy of Edtech products for teachers, created through a two-pronged approach: theory-driven and field-driven. The classification is based on mapping affordance to teacher objectives. This taxonomy will help teachers and Edtech researchers provide insight into tools that are mapped to their needs. We analyzed existing reports to identify different categories of teacher products existing and what additional types are needed when the focus is on teaching with Edtech. From the Taxonomy of Edtech tools, we found that learner-centric activity tools are more trending than TPD tools. From the field-driven analysis of Edtech tools for teachers, we have found very few tools under the lesson study category that facilitate a tutoring system by which teachers can develop and sharpen their teaching competencies. The limitation of the work is that it scopes out content creation and classroom management tools from the taxonomy. Also, the example set includes only 80 tools. LMS is included in the taxonomy but further analysis on the quality of integration of the diverse functionalities is required to complete the taxonomy and is, therefore, planned as future work.

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