Including the excluded, connecting the disconnected: lessons from a large scale experiment in India of designing open educational technologies that work for all

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Abstract: Efforts to harness technology for improving school education have gained traction internationally. However, these efforts have been reported to encounter multifarious challenges ranging from poor ICT infrastructure to wicked problems of technology design, implementation models and inadequate teacher capacity building. In resource constrained contexts, these challenges get exacerbated by various other systemic and non-systemic factors. In this presentation, drawing upon our experiences from a large scale technology enabled educational intervention - Connected Learning Initiative (CLIx) – in India, we present and discuss aspects of design, development and deployment of scalable EdTech solutions that provide learning opportunities in low-tech and resource constrained environments.

Keywords: connected learning; edtech; lego design; learning platform; open standards

Introduction

Here, we propound two arguments: first, pedagogic underpinnings of educational technologies play critical role in developing effective learning solutions; second, design considerations of technology architecture play vital role in creating transformative EdTech solutions.

Aproposing the arguments, we share the experiments and lessons learned from the design, development and deployment of gStudio powered CLIxPlatform – a Next Generation Digital Learning Environment (NGDLE) for school students and teachers. We would also demonstrate and discuss how thoughtfully designed open standards compliant, digital learning system architecture is engendering innovations for connected learning in disconnected space in the remote districts and underserved communities across India.

1. Pedagogic underpinnings shape the efficacy of EdTech solutions

While embarking on the ambitious initiative of CLIx to demonstrate a model of “quality at scale”, the authors and colleagues at CLIx, sought to analyze past mistakes in the area of EdTech interventions. We consciously spent significant time during the initial phase of the initiative, in thinking about the aims of education and pedagogical nuances offered by technology and what worked and did not work for previous EdTech interventions (Selwyn, 2011; UNESCO, 2015). One of the prominent observation was that, more often than not, in the EdTech discourse, technology adopts an imposing posture which eventually gets tacked-on to the teaching-learning process. Such a technology-driven approach seemed inherently flawed as it pre-supposes usefulness of technology in Education without adequate considerations of educational aims. As a result, educational or learning technologies, apps or platforms take little cognizance of pedagogical nuances and thereby reinforce transmissive pedagogies and shallow learning (NCERT, 2006; OECD, 2015; Weller, 2018).

We became convinced that before thinking about use and integration of ICTs in Education it is imperative to have clarity about our philosophical and pedagogical positioning. Informed by the educational literature, we developed a framework of three pedagogical pillars (see figure 1, below) around which the entire CLIx intervention as well as the resulting EdTech solutions have to revolve. As can be seen, the three pillars are representative of a particular conception of education, learner and teacher within the larger educational literature. The rationale, choice and limits of these pillars have been discussed elsewhere (CLIx, 2018).

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However, the argument, in this presentation, is about the vitality of having pedagogical clarity as an *apriori* of designing EdTech solutions.

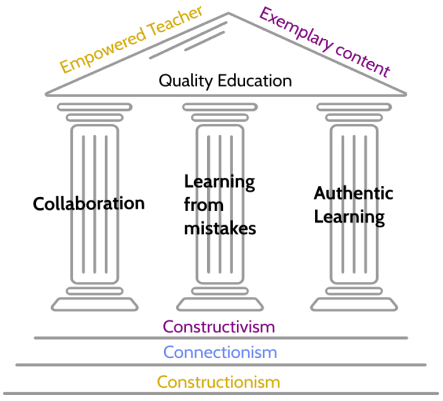


Figure 1. CLIx Pedagogical Pillars

Having the underpinnings set, we embarked on finding existing EdTech solutions as well as developing new solutions. Therefore, the quest was not merely incorporation of computers, laptops, videos or games; instead the thrust was placed to find EdTech artefacts that help facilitate pedagogical aspirations. As a result, the CLIxPlatform – a Next Generation Digital Learning Environment (NGDLE) which resulted from the CLIx initiative (explained in next section) visibly embodies the constructionist pedagogy in its outlook and features. By design, it encourages interactivity, creation, collaboration and allows to do mistakes and repeat. These features are markedly different than many, popular, consumption modelled, platforms/LMSes (learning management systems) in the EdTech market which generally focus on audio/visual tutorials based transmission/broadcasting pedagogy.

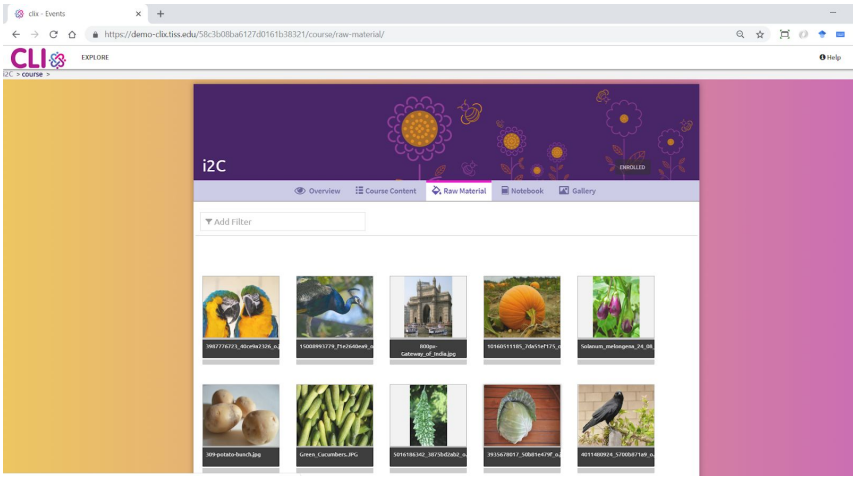


Figure 2a. Collaborative learning features of CLIxPlatform - Gallery and RawMaterial

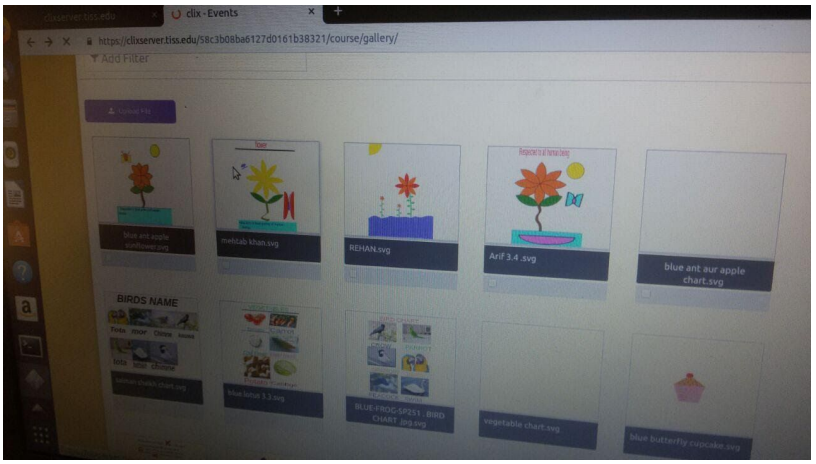


Figure 2b. Collaborative learning features of CLIxPlatform - Gallery of learners' artefacts

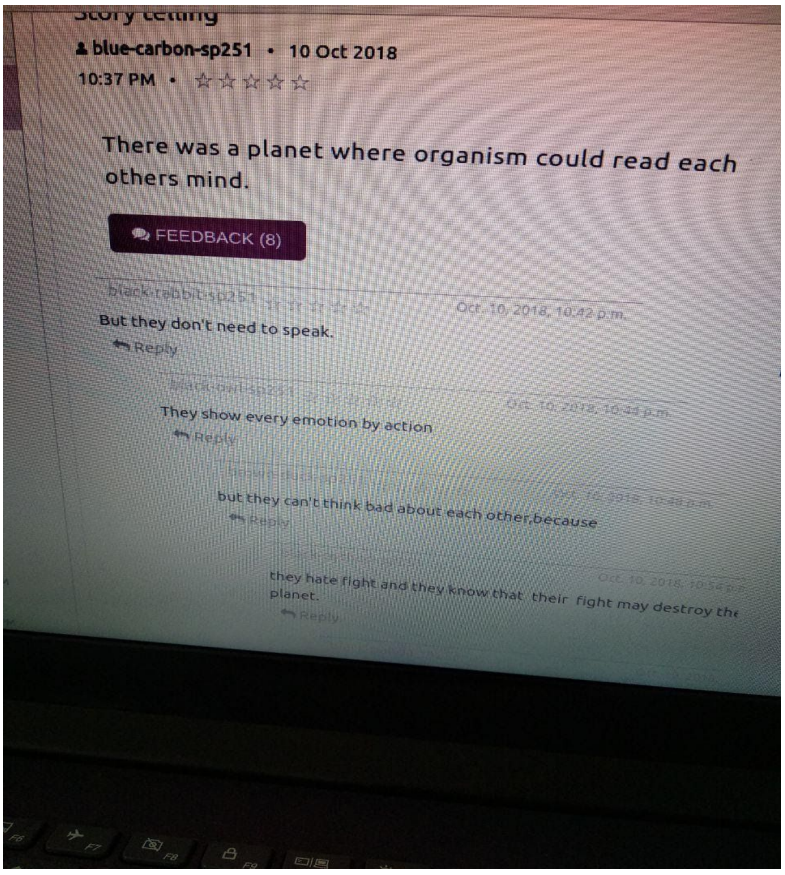


Figure 2c. Collaborative learning features of CLIxPlatform – e-Notes and discussion features

As a consequence of such as a design we found (see Figures 2a and 2b) that learners embark on an active knowledge construction journey and create artefacts that fosters deep learning and unleashes creativity of young minds. As could be seen in Figure 2c, learners also engage into civilised discourse in a protected environment learning platform.

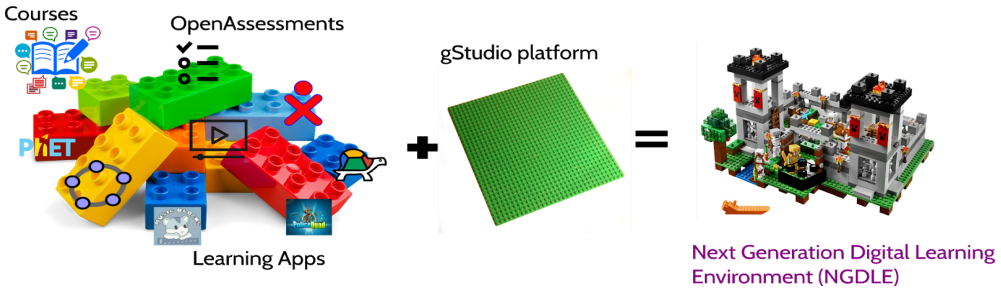
In the next section we discuss about the *design* aspects of educational technologies.

2. The "Lego" approach of designing educational technologies:

Worldwide, the EdTech industry is mushrooming with innumerable applications and platforms. Even a cursory analysis (Weller, 2018) of the global EdTech landscape brings to fore an issue of "walled gardens" (Brown et al., 2015) i.e. in the landscape of numerous EdTech apps and platforms every other app/platform seems to stand different and agnostic of other app/platform. Learning content/components developed on one platform can neither be exported to or imported from other platforms because of architecture design incompatibilities. Such incompatibility of design between EdTech solutions limits efforts and possibilities of each application to itself, hence making it a walled garden. Moreover, this lack of interoperability of content and features between EdTech solutions impairs any vision for aggregation. As a result, multiple EdTech solutions are getting rendered as unusable, outdated walled gardens limiting the opportunities for both the developers as well as users. Therefore, such a design for EdTech is flawed and unsustainable.

Here comes our second proposition, that architectural design considerations should be prominently considered while developing learning technologies. Here, by *design* we mean the architectural or enterprise schema of technology applications/solutions (while acknowledging the importance, we do not discuss the aspects of user experience design in this paper and keep it for another occasion). We propound that as against an all-in-one EdTech application/platform we need to move towards a “Lego approach” (Brown et al., 2015) of designing enterprise learning solutions. The Lego approach envisages creating a mash-up of open standard (such as LTI[4], QTI[5], SCORM[6], OSID[7]) compliant solutions and tools to design enterprise solutions such as Next Generation Digital Learning Environment (NGDLE). Such a “digital confederation” (Brown et al., 2015) of applications allows possibility of combining multiple platforms/solutions to powerfully extend the educational possibilities.

Figure 3. Lego model of creating next generation digital learning environments



We thought this could be a truly powerful idea to create transformative EdTech solutions. Consequently, based on our requirements, we worked to extend an existing software stack of gStudio from an OER repository to make it a course maker (CMS) and course player (LMS). This extension of gStudio was informed by the pedagogical framework as outlined in previous section. The course maker, course player and repository features formed the core of CLIxPlatform. However, we were keen to have many more features such as assessments, interactives and simulations. Thus, adopting the Lego approach, instead of creating all features and applications on our own (which we thought is akin to reinventing the wheel) we looked for existing solutions that were a) conforming to our pedagogical framework; and, b) compliant to open standards; and c) open source

We found some solutions already existing in the EdTech arena and we took advantage of those. For rest, we designed and developed open-source, open standard compliant solutions.

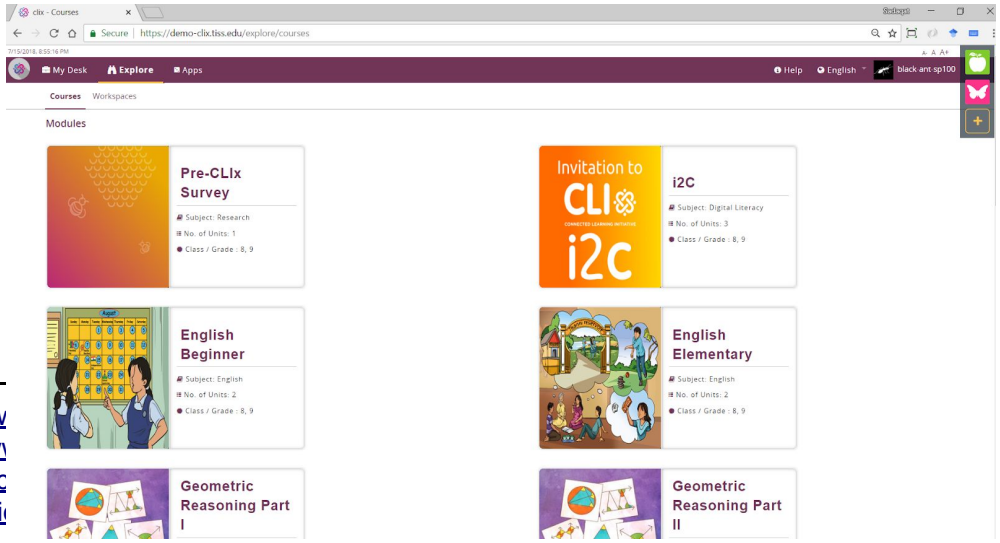


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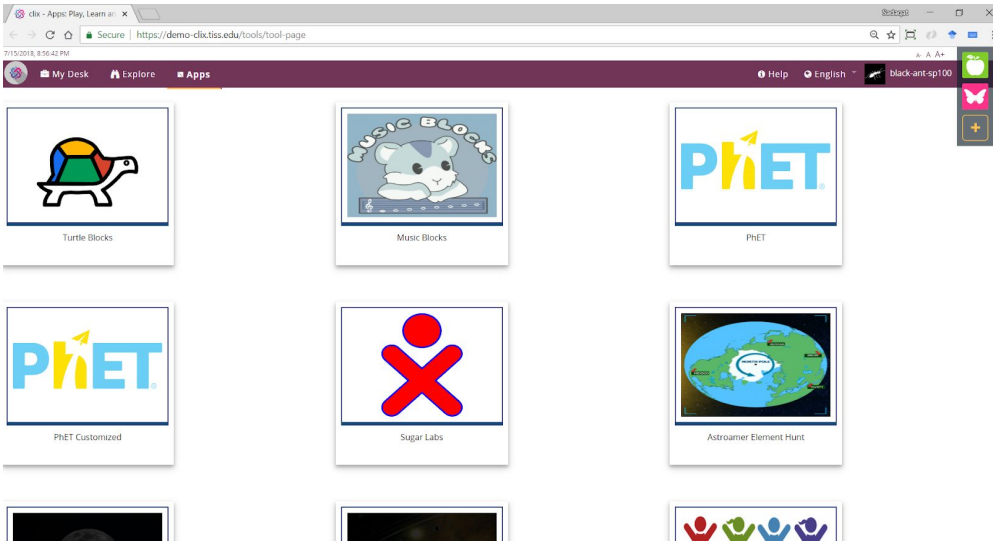
Figure 4a. Course modules on CLIxPlatform (a next generation digital learning environment)

Figure 4b. Learning apps on CLIxPlatform (a next generation digital learning environment)

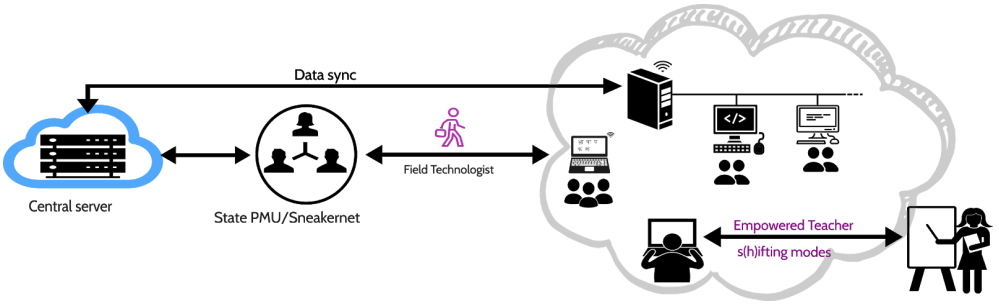


As depicted in figure 4a and 4b, above, what came out of the Lego modelled approach was a fascinating mash-up. We were able to integrate some amazing learning apps with the gstudio platform which acted as Lego board. Thus the resulting CLIxPlatform contained a range of in-house developed apps such as CMS/LMS/Interactive tools as well as independently developed apps such as OpenAssessments, TurtleBlocks, PhET simulations, GeoGebra. This powerful orchestration of various staggered learning solutions as one seamless enterprise solution has opened up multitudes of learning possibilities to learners in schools across India (prominently in CLIx interventions states of Chhatisgarh, Mizoram, Rajasthan and Telangana). The CLIx initiative has been working with several hundreds of schools with CLIxPlatform deployed since late 2016.

Innovations in design for constraints:

In majority of public schools in India, high speed internet connectivity is still a distant dream. Therefore, a significant majority of schools and learner are yet to experience the power of internet and learning technologies. As can be noted, from the very name of initiative, in CLIx, we were keen to provide connected and collaborative learning opportunities. In general, connected learning has become synonymous with internet connectivity. Therefore, this containt engendered an innovation. To fulfil our pedagogical vision, the CLIxPlatform is packaged as a DOER – *Distributed Decentralized Offline Open Educational Resources* which is an *internet-in-a-box*[8] solution.

Figure 5. CLIx supported school ICT lab, connected learning in disconnected spaces



[8] http://internet-in-a-box.org/

As shown in Figure 5, above, in a school ICT lab, DOER provides connected learning experience in a disconnected space through Local Area Network (LAN). In the LAN, the DOER server forms a local cloud and enables, anyone connected to the local server, to access thoughtfully designed teacher-learning resources using a browser. Therefore it provides internet-like experience in internet-less environment.

In the above sections, we propounded two arguments regarding importance of pedagogical underpinnings and design implications of educational technology solutions. To substantiate the arguments, we shared our experiences of a large scale EdTech intervention. We argued that enterprise EdTech solutions should avoid the problem of "walled garden" and comply with open standards to leverage the innovations in the EdTech landscape by building a mash-up learning solution. We envisage such a digital confederation of EdTech components and tools which goes beyond the monolithic Learning Management System (LMS) to be the way forward for next generation EdTech that can unleash the transformative potentials of technology to open up education for an open future.

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