

Connected Learning Initiative (CLix) India

<https://clix.tiss.edu/>

Preface

Global south in general and south Asia in specific is home to the largest share of world's youth population. With 48 percent of its population below the age of 24.5, south Asia's young people posit enormous potential to drive global development - economic, technological, human - towards a more prosperous, happy and equitable world¹.

However, in order to make this large young cohort productive it is imperative to enable them with educational opportunities and 21st century skills. The Sustainable Development Goals expressly direct the governments to do so in SDG 4 ("ensure inclusive and equitable quality education and promote lifelong learning opportunities for all")².

In India, while the Right to Education Act 2019 - that mandates free and compulsory education for children upto age of 14 - has resulted in increased enrollment, the quality of education remains a concern. World wide there is growing interest in harnessing technology to improve quality of education. With their myriad possibilities the new media and digital technologies do offer multiple opportunities to leverage for educational purposes.

Since year 2005 the Government of India has been introducing computers through Information and Communication Technology (ICT) labs in government schools across India. Over the years availability of computers in schools expanded. However, in this pursuit of widening access to devices, the aspects of pedagogy and meaningful use of technology for educational purposes remained neglected. Meaningful use of technology for education requires upskilling and pedagogical shift in teachers. In absence of which the devices may remain as anything but educational resource.

¹ UNICEF. (2017). *From Education to Employability: Preparing South Asian Youth for the World of Work*. Retrieved from <https://www.unicef.org/rosa/media/1326/file>

² <https://sustainabledevelopment.un.org>

About CLix

Connected Learning Initiative (CLix) was conceptualised as a bold and innovative intervention, with global relevance for quality teaching & learning in the public education system of India. The overarching goal was to demonstrate *quality at scale* through meaningful use of new media and digital technologies. CLix offers students opportunities to work in a hands-on manner to construct knowledge in active ways, and enhances the prospects of professional development for teachers in their respective subjects through the use of ICT. The initiative, founded in 2015, is seeded by Tata Trusts, India and led by Tata Institute of Social Sciences (TISS), Mumbai, India and Massachusetts Institute of Technology (MIT), MA, USA.

As an open innovation project, CLix believes in developing an ecosystem of open educational practices leading to quality in education. It aims to improve the academic prospects of high school students from underserved communities in India. With this spirit, over the years CLix evolved as a multi-state, multi-partner initiative and collaborated with the governments of Rajasthan, Mizoram, Chhattisgarh and Telangana to work in government-run high schools; to leverage expertise in different curriculum design, creation of educational resources and educational technology development we formed partnerships with Eklavya (Bhopal), Homi Bhabha Centre for Science Education, (TIFR, Mumbai), Inter-University Centre for Astronomy and Astrophysics (Pune), National Institute of Advanced Studies (Bengaluru) and Tata ClassEdge (Mumbai).

Having a strong field action focus CLix built its own teams at Chhattisgarh and Telangana to support State Council of Educational Research and Training (SCERT) of the respective states, to implement the program. However, the initiative collaborated with Centre for Education Research and Practice (Jaipur), and Mizoram University (Aizawl) as implementation partners in Rajasthan and Mizoram respectively.

Through such extensive collaborative efforts, since 2015, CLix has been offering secondary school students technology-enabled STEM resources (10 modules), Digital literacy (5 modules), communicative English & Life skills (40 hours) on a platform suited to Indian conditions, professional development for their teachers and support to maintain and use ICT labs in school. Teacher Professional Development is available through professional communities of practice and the blended Post Graduate Certificate course in *Reflective Teaching with ICT*. All its resources have been/are being made as Open Educational Resources and designed to be interactive, foster collaboration and integrate values and 21st century skills, aligned to the pedagogic vision of the National Curriculum Framework 2005. These modules are available in Hindi, Telugu and English to 478 schools in which ICT labs have been activated. So far, across states, 60,176 students in Grades 8 and 9 have benefited from the modules. 3145 teachers have participated in Teacher Professional Development workshops and are on mobile-phone enabled Communities of Practice. Moreover, 478 head teachers and 238 teacher educators have been part of the intervention.

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For its efforts, CLix has also been recognized internationally and won UNESCO's prestigious 2017 King Hamad Bin Isa Al-Khalifa Prize for Use of Information and Communication Technology (ICT) in the field of Education and was selected from a pool of 143 international entries from around 79 countries in March 2018.

CLix - an Open Innovation and Open Practice initiative

Over the years CLix has emerged as a disruptive open innovation that leverages open innovative tools and technologies which engender open educational practices. The attempt has been to develop systems' capacity to adopt open educational practices and improve quality of learning in the public education sphere.

In the subsequent section we outline some of our salient tools and practice.

The CLix EdTech Enterprise Solutions Stack: A Case for Equity and Innovation in Technology Design

Globally, while the proliferation of EdTech solutions continues unimpeded, its efficacy and impact on learning is yet to be established firmly. However, one advice that prominently emerges from most of the published research on educational technology interventions is - to avoid techno-centric approaches and mend technology for specific educational goals.

In CLix, from the very inception, we attempted to be mindful about this admonition. Therefore, building on the educational philosophies of constructivism and constructionism we first defined our pedagogic pillars - collaborative, authentic learning and learning from mistakes - and then ventured into designing technologies that could facilitate these educational objectives. As a result, the CLix EdTech solutions stack expressly embodies these pillars and offers features that encourages active and interactive learning.

In the 478 schools across India where CLix is being implemented, from hardware machine configurations to operating system and software support, there is immense diversity in the school ICT lab infrastructure. In fact, much of the equipments are outdated and are well beyond any support period. Historically, these machines were dumped in schools as part of a government scheme ICT@School but there was absolute lack of understanding how to leverage ICTs for education beyond word processor, spreadsheets and paint. Hence, the ICT labs remained dysfunctional. For us, the challenge was not only to design such technology solutions that work in retrograded, minimal and low-tech conditions but also to ensure that the learners are not deprived of latest, cutting edge tools. This required a lot of innovations in design and deployment. Furthermore, we were also responsible to activate these dysfunctional ICT labs and make the EdTech solutions work. We embraced the challenge and over past three years the relentless efforts have resulted into a software stack for next generation digital learning environment that has run successfully in very same hitherto dysfunctional labs beyond our expectations.

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Since 2016 we had three major iterations and as of June 2019 the EdTech enterprise solution stack includes

1. CLIXPlatform - a next generation digital learning platform powered by gStudio
2. Unplatform - a light weight LMS
3. OpenAssessments - an assessment engine
4. Several interactive apps
5. DOER - distributable open educational resources, a software distribution package that works both online and offline
6. TISSx - an Open-edX powered MOOC platform for teachers' CPD
7. TISSx android app
8. Intervention Monitoring Tool using OpenDataKit

Over three years of rigorous field engagement and interactions with various stakeholders we now understand the asks and expectations of wider educational ecosystem and affordability of ICT tools for an effective and impactful intervention. The field action brought forth unique challenges, and we have come to realize that in order to expand the reach of educational opportunities it is imperative to devise technological solutions that are adaptable in resource constrained schools and are agnostic to devices and availability of latest infrastructure.

CLIX Platform

CLIX platform is a next generation digital learning platform that runs on gStudio³ codebase and is designed for a range of learning activities rooted in collaboration as a key principle. The platform is a course-maker (CMS); course-player (LMS) and an OER repository. Currently it hosts more than 200 hours of interactive content in the subject areas of Digital Literacy, English, Mathematics, Science and Values Education for the secondary school level. These interactive modules are aligned with national curriculum and are available in three languages English, Hindi and Telugu.

The CLIXPlatform demonstrates a number of innovations in design. For instance, buddy login is one of the key features available which innovatively addresses the scarcity of computers in the school lab. Using buddy login more than one learners can sit together on single computer and can concurrently login; and, their progress and contributions gets shared to each of the buddy equally. In this way, the challenge of high student to computer ratio was taken to advantage to foster collaborative learning and learners were happy to see that despite sharing one computer their individual identities are not getting suppressed. The platform also offers many such collaborative affordance - learners can write notes, create and upload artefacts, give and seek feedback, can review others artifacts and many more. All these features make the learning more engaging and richer in experience. The OpenAssessment based formative assessment engine provides more than 13 types of interactive questions and seamlessly

³ <https://github.com/gnowledge/gstudio/blob/master/doc/index.org>

integrates with the CLix Platform. The CLix platform, assessment engine and interactive tools also capture the analytics and makes it available to the learners making the learning progress visible to learners.

In times of mushrooming platforms and apps interoperability becomes an important consideration. The gStudio broadly complies with open standards such as SCORM⁴, OSID⁵, OpenAPI⁶, schema.org and LTI⁷. Following the spirit of interoperability the gStudio CLix Platform is highly agile and can be thought as a *Lego* board which allows integration of n-number of lego blocks. Such a *Lego* modelled platform helps avoid creation of “walled gardens” where no content/component can come in or go out of the parent application. Currently, there are many open standard compliant applications such as TurtleBlocks, PhET simulations, Sugarizer integrated with the platform and the courses can be exported in EPUB3 format and can be played on any EPUB reader.

When hosted online the CLixPlatform works on a cloud⁸ providing anytime anywhere access. However, most of the public funded schools in India still do not have internet connectivity. Therefore, the CLixPlatform - with all the courses, learning games, simulations, curated OERs and educational softwares- is packaged as a DOER (distributed offline OER) disk which takes inspiration from internet-in-a-box concept. In the school ICT lab, the DOER disk works in a client-server setup, where one desktop machine acts as a server, and all other machines connected in the local area network (LAN) act as clients. In this setup, even while offline, the applications open using a browser. Therefore, even in the most remote and disconnected space the learners get an opportunity to experience internet like experience without internet. The collaborative features of comments, posts, feedback and ratings facilitate a civilised discourse in a protected environment. The idea of DOER is a powerful innovation to bridge the digital divide and to extend the benefits of new media to unreached and underserved regions and communities.

The offline CLixPlatform server also runs synching⁹ service which syncs the data analytics to the central server based on opportunistic availability of internet. Such a feature has been enormously helpful in the implementation monitoring, understanding the quality and depth of engagement as well as getting feedback from the field. It also helps in designed based research approach to improvise the learning quality and experience.

One might ask, how are the young learners’ identities protected when data is being captured and synced out of school? Aware of the importance of confidentiality guideline and research ethics we attempted a simple yet powerful innovation in design. We did anonymization at the source. That is, all the users in a school get pre-created login IDs having pseudonyms comprising color and an animal or fruit, such as

⁴ <https://scorm.com/>

⁵ <http://osid.org/>

⁶ <https://www.openapis.org/>

⁷ <http://www.imsglobal.org/activity/learning-tools-interoperability>

⁸ <https://demo-clix.tiss.edu>

⁹ <https://synchting.net/>

blue-parrot, red-tiger, pink-rose etcetera. Whereas the teachers get the login IDs having a combination of color and chemical element such as red-copper, yellow-silver and so on. Thus, user identities are masked at the source. This simple innovation has had twin affects:

- 1) It protects young vulnerable learners as stipulated in confidentiality guidelines,
- 2) It gives agency to children and gives to avenues to express themselves without fear of bullying (the teacher get the admin rights to moderate conversations)

When such measures are taken then learning takes centre stage. Right to privacy and protecting one's identity is an important 21st century skill/right that needs to be inculcated in one and all. We have been able to do it in a very organic manner with tens of thousands of young children across India by thoughtful design of EdTech.

While the platform has got traction on the field based on the users feedback and our own field observations, like any good product it requires enhancements to further improve learning experience. We happily say that its still work in progress and the next version will be the best version! Therefore, we intend to,

1. Make the overall footprint of application lean and lighter
 - a. Do performance optimization through integration of elasticsearch
 - b. Upgrade django from 1.6 to 2.2
2. Make the user interface responsive and comply with usability, accessibility and UDL guidelines
3. Bring full compliance with LTI and SCORM to make it seamlessly interoperable with other standard compliant platforms such as Moodle and Open-edX
4. Extend the gStudio API¹⁰ support to cover the entire stack so it becomes interoperable with any web server
5. Integrate H5P in offline DOER
6. Complete the support for internationalization
7. Enhance and integrate analytics engine¹¹ by building a comprehensive dashboards and make learning visible to all stakeholders
8. Package in various customizable/plug-and-playable distributions
9. Release all the learning apps as standalone installable OERs

The Unplatform

Unplatform¹² is a lightweight, standalone learning management system (LMS) that uses EPUB as the content source. It works as a generic, browser-based EPUB reader that also supports embedded assessments and interactive tools using the Open Service Interface Definitions (OSID) specifications. Bringing standards compliant interactivity to EPUB reader is the central philosophy of the application.

¹⁰ <https://gstudio-docs.readthedocs.io/en/latest/api.html>

¹¹ https://clixindia-dev.github.io/clix_vis_demo/

¹² https://github.com/CLIXIndia-Dev/unplatform_v2/wiki

The courses exported from CLixPlatform as EPUBs can be bundled into unplatform. As it is lightweight it's easy to distribute and use as standalone app by students and teachers on their personal devices. Since the unplatform consumes less resources as compared to CLixPlatform, it is capable of running on low-configuration/non-upgraded infrastructure. Currently the build process supports Unplatform distribution with UI support for English, Hindi, and Telugu languages. The user analytics though captured on individual machine, its not visible to the learners. It also provides limited collaborative engagement features.

During the initial phase of our initiative, we had installed 'Unplatform' in 170 schools in India that then lacked the infrastructure to support the server-client model to run the CLix modules. After three years of experimentation with both CLixPlatform and Unplatform we conclude that given the diversity and stark disparity in terms of ICT infrastructure and devices between regions and schools and people there is a genuine need to provide both the options so that no one is deprived of learning opportunities because of constraints. Unplatform makes a classic example for a Low Threshold High Ceiling learning app.

Therefore, we plan to upgrade the Unplatform and would like to,

1. Add collaborative features and peer-to-peer interaction
2. Make progress visible to learners
3. Make the UI responsive and convert it into an app for mobiles/tablet users
4. Make it even more lean through modularised assessment export from CLixPlatform
5. Enable opportunistic use of internet to sync data for monitoring and research purposes

TISSx

Teachers are the pivots of any education system. Harnessing new media and technology for learning inevitable requires building capacity and confidence of teachers. Therefore, teacher professional development (TPD) is one of the main focus of CLix intervention. After initial training workshops, teachers are enrolled into engaging courses hosted on TISSx¹³ - an OPENedX powered online platform. Teachers are also formed into mobile based online communities of practice for continuous support.

One of the reasons for using an online platform for TPD courses was because of the surge in mobile based internet penetration in India. According to statistics¹⁴ internet access through mobiles constitute more than 95% of total internet consumption. Therefore, we also developed a mobile app¹⁵ for the TISSx. As expected, we found that teachers find it more convenient to access the courses on mobile because it gives flexibility of anytime anywhere access. We also have a Telegram bot called MiTi which allows TISSx courses to be accessed from Telegram.

¹³ <https://www.tissx.tiss.edu>

¹⁴ Internet users in India to reach 627 million in 2019: Report. (2019). *The Economic Times*.

¹⁵ <https://play.google.com/store/apps/details?id=edu.tiss.tissx.app>

Courses on TISSx are practice-based and go hand in hand with the student modules implementation. While the pedagogical aspect of teaching-learning process are at center, the course assignments also requires teachers to report the outcomes of student modules rollout. TISSx platform provides systematic offering of courses with assessment and certification.

While TISSx is a customized version of OPEN-edX, we are continuously improving both the website and the mobile app to make it more interactive and seamless user experience for Indian school teachers.

Therefore, we would like to,

1. Bring interoperability of student modules from gStudio powered CLIXPlatform
2. Introduce interactive features in mobile app
3. Integrate analytics from TISSx and CLIXPlatform

Community of Practice

The Community of Practice (CoP) that foster learning and growing of the individuals in the professional groups in a democratic manner (Wenger-Trayner, 2015) is a key aspect of the initiative. Since the intervention is widespread and the number of people on the ground are few in number, the need to leverage technology to bring teachers to a common platform to exchange ideas, to share practices and to get their doubts resolved was keenly felt. This need has been addressed through the use of Telegram that is known to focus on interaction helps the user integrate into a wider world while still maintaining one's privacy such as personal phone number or email IDs which are made visible on other apps. The fact that it allows for more users to be in the same group aided us greatly as one of our state groups focused on ICT and Education has more than 1000 teachers.

We are working towards enabling states to also adopt Telegram as a social networking platform for their teacher communities and to post discussion triggers, disseminate and collect information through the app using other tools such as YouTube videos (dissemination purposes) and Google Forms and Telegram polls (collection purposes). We are also working on adapting/adopting better data analytics than current conventional systems to allow for reflections on education practitioners' thoughts by, of and for themselves.

Currently, we have 16 active Teacher CoPs with over 3000 teachers and state officials across the 04 states we operate in.

ICT Lab Maintenance and Sustainability at Scale

To achieve quality and sustainability at scale there it is inevitable that we nurture local system which can take care of maintaining the infrastructure so that more focus will be on teaching learning process. CLIX has been working towards building technology support groups at educational district and block level by training mandal/block MIS coordinator to support schools in maintaining the labs.

As we understand the need and the current technical skills of teachers in the government schools, we plan to provide ICT lab in School course and provide a toolkit with help videos and reference documents. Subsequently, these teachers will form students tech force groups who can maintaining the school ICT infrastructure and will intern pass the knowledge to their juniors upon their own exit, so that the school ecosystem becomes self sustained. In the next one year we propose to train 500 teachers and 2500 students in 500 schools. This will be one of its own kind experiment of strengthening local school's ecosystem and will go a long way in empowering the otherwise resource constrained public schools that still cater to more than 70% of student populace in India¹⁶.

CLix OER Release

All CLix content is currently released under the Creative Commons Licence 4.0. True to its vision, in the coming year, CLix aims to convert the modules and other assets into Open Educational Resources (OERs) that can be reused, re-created, modified and adapted to varied contexts. It aims, in the process, to be truly free - where we define 'free' as the spirit of freedom and independence to create, learn and grow!

The CLix Scale Strategy

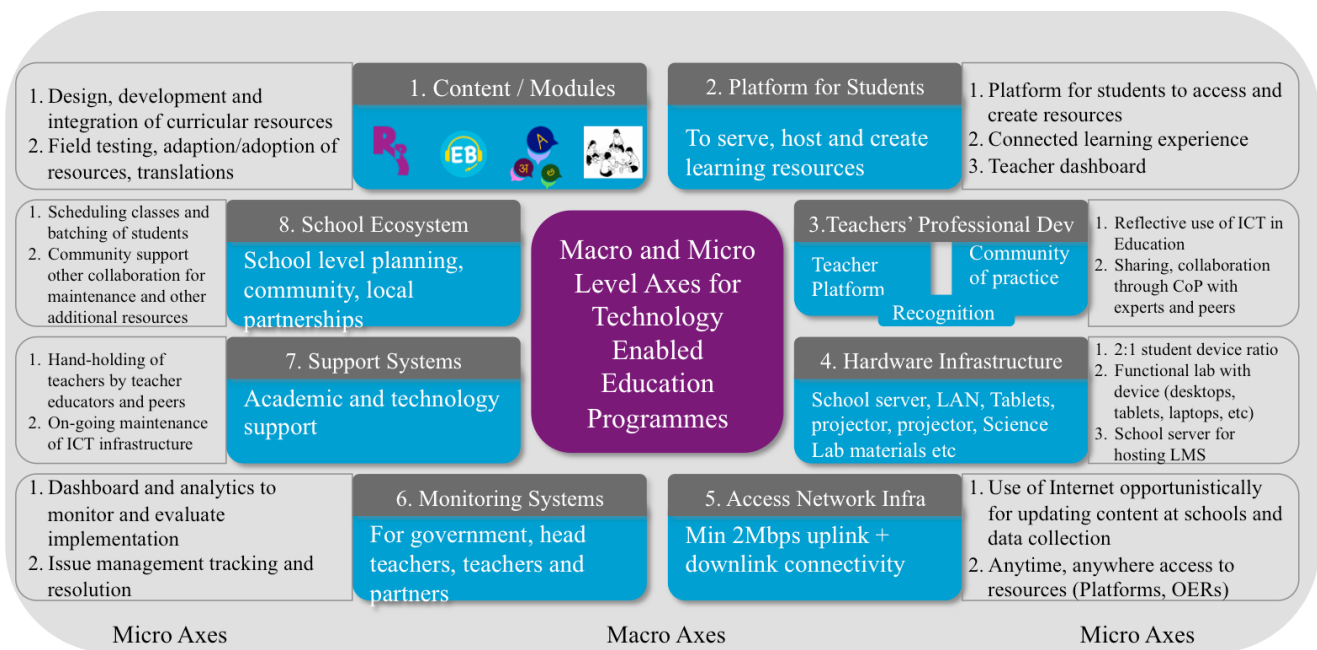


Fig. 1: The 8 Macro Axes and 18 Micro Axes of the CLix Scaling Model

¹⁶ NIEPA. (2019). *Elementary Education in India*. National Institute of Educational Planning and Administration. Retrieved from http://udise.in/Downloads/Publications/Documents/Analytical_Table_2016-17.pdf

The design of the intervention has been modelled to be adopted and scaled in different contexts as its well integrated into the system by being built upon existing infrastructure and resources at the state level. Strengthening state academic institutions like State Council of Educational Research and Training, College of Teacher Education and developing a cadre of teacher educators for ICT Education has been a major activity for preparing states to scale the programme. Scalability of CLix is intrinsically embedded in the flexible technological offerings where all its student resources reside and in its design of modular offering for teachers with its blended courses on Open edX platform that offer the possibility of unprecedented scaling of these high-quality interactive learning opportunities in the form of ‘courses of study’.

CLix focuses on making learners producers and not mere passive recipients of content. CLix actively seeks to enable teachers to source external content, modify it or create new content and share their expertise and develop their community. The initiative similarly invites state officials to think of innovative ways to deliver quality learning to students through adaptation/adoption of tools and processes.

Through our work in four states of India, the positioning of CLix has been able to sustain due to these factors along with the consistent yet rapid resolution of infrastructural and systemic challenges. Moreover, student modules can be adapted and customized to local contexts in 7 Hindi speaking and 8-9 English speaking states in India and in other regions within South Asia. The initiative works with the existing systems as it aims to complement and supplement educational resources and processes.

CLix Impact

CLix being an action research project has strong monitoring mechanism with base-line, mid-line and end-line research¹⁷ using a design based framework to analyse the efficacy and impact.

Our research indicates that all students, including students from SC, ST and OBC categories were found to make significant gains in basic and intermediate technical skills (significant at 5% level and ST students gain greater than overall) and application based technological skills (significant at 5% level significance). Teachers have demonstrated improved ICT skills and positive beliefs about technology in education through their engagement and participation in online subject groups.

Findings from learning outcome study in which we have been able to work very very closely with teachers to achieve high level of implementation fidelity have shown significant gains among students in Mathematics (avg 7.16 points gain), Science (avg 13 points gain) and English (avg 2.12 gain in listening and avg 8.51 gain in speaking). An endline study is in the final stage of completion and will provide a better sense of the learnings shifts in the population.

¹⁷ <https://clix.tiss.edu/research/publications/>

On the systemic front, all the governments in invention states now recognize the need for shifting focus on pedagogy than technology. The public education system has started developing strategies for teacher professional development for the use of ICTs in Education. Government of Chhattisgarh launched CG-OER¹⁸ which is being facilitated by CLIX. We are also helping the state to devise strategy for developing multi-modal Open Education Resources in vernacular languages.

Therefore, there is substantial evidence to say that CLIX demonstrates a workable model for quality at scale by harnessing open technologies and open practices that public education system in India can adapt.

Future Goals

The research and evidence show that thoughtfully designed technology can play a transformative role in opening up educational opportunities for all learners especially the excluded and underserved; it can also empower teachers to be the catalyst for positive change.

With the experiences of intense piloting phase spanning over three years 2016-19 and positive indicators of outcomes, we now propose to scale the implementation of CLIX and widen the reach of innovative EdTech solutions. We are in the process of taking CLIX to 1500 schools in the state of Chhattisgarh. The choice of state is based on keen interest from the state officials to not only adopt CLIX model but to take it forward. We are engaged in similar talks of expansion in the state of Telangana as well.

Additionally, we would like to strengthen, diversify and enhance our EdTech solutions stack comprising a state of the art learning platform, a light weight LMS, an assessment engine and more than a dozen interactive learning apps with multilingual support. We also would like to diversify our deployment model of distributable OER (DOER) or internet-in-a-box so that these apps are ubiquitously available even in low-tech environments and become device agnostic. Our attempt has been to make technology in education should be of Low Threshold High Ceiling. That is, entry point for using EdTech should be very simple however there should be scope for extended possibilities. Releasing these generic and customizable EdTech enterprise solutions and alongwith exemplar content can be extremely useful for educators especially in the resource constraint contexts of global south. We strongly believe that an equitable EdTech is essential to achieve SDG 4 goals to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

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[https://clix.tiss.edu/
CLIXHandbook](https://clix.tiss.edu/CLIXHandbook)

¹⁸ <https://nroer.gov.in/cg>