Adapting Technology to Support Teacher Training Processes

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Abstract

Every year, states are allocated hundreds of crores of rupees to run in-service teacher training programmes under various quality interventions, to improve student learning levels. However, the National Achievement Survey (NAS) 2017 continues to reveal low levels of learning in students in Class 3, 5, and 8. Among the reasons behind this are the great heterogeneity and the vast scale of programmes, the lack of clarity on the academic roles of supervisors and missing operating procedures, leading to the absence of academic and pedagogical support teachers need in order to transform their classroom and enhance student learning.

Technology can enable quality and specificity of inputs to strengthen such efforts. However, tech-based solutions implemented by states often assume a punitive role and fall short in terms of contextualisation and ease of use. Lack of high-speed internet access, the diversity in device specifications, inadequate end-user experience, unimaginative and unexciting user interface, and unclear motivation for the task are some of the reasons why these solutions fail to meet their intended objectives.

Ignus Pahal, with the support of the State Project Office, SSA, Uttar Pradesh, and UNICEF-UP, ran a programme called TELOS in 8246 government primary schools of five districts of the state in 2018-19. TELOS made extensive use of technology to enable quality and contextualisation at scale while addressing the challenges mentioned above. In this paper we provide an elaborate description of the design principles behind the 'TELOS approach'.

Keywords: *teacher training, technology in education, supportive supervision, open source*

Part I: The Problem

A. The Picture On Ground

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It is well acknowledged that an improvement in the teacher's classroom practices leads to an improvement in student learning (Guskey T. R., 1986) (Guskey T. R., 1985). Consequently, improving teacher performance, especially through in-service training has been emphatically supported in India over the last two and a half decades. For instance, the MHRD allocated as much as Rs.164 crores for teacher training in the state of Uttar Pradesh for the academic year 2019-20. (PAB-UP, 2019) In comparison, Meghalaya, one of the smaller states in India, received 6.68 crores. (PAB-ML, 2019). Similarly, hundreds of NGO interventions might be involved in conducting or supporting teacher training in a typical state. Whether this is achieved through techniques of contemporary pedagogy, modern technology, efficient planning, integrating arts, or by generating motivation, depends on the specifics of the intervention. (MHRD) (Jagannathan, 2000) (Colclough & De, 2010)

However, measuring the degree of improvement brought about in teacher performance presents a challenge, with the effect of inputs to teachers remaining unclear and often unmeasurable. Though India made a beginning on this aspect with the creation of ADEPTS (MHRD, 2007), a framework of performance indicators that makes it possible to measure teacher performance, its utilisation to measure effectiveness of teacher development inputs has been, at best, patchy. Similarly, attempting to assess the impact of in-service training through the proxy of student learning outcomes too remains uncertain. For instance, many of the NGO interventions mentioned earlier spend considerable resources on conducting baseline and end-line assessments of student learning. Strangely, though these interventions display an improvement in learning levels in their own individual studies, the National Achievement Survey fails to show a similar overall improvement.[1]

An often-overlooked element in this quest for improved teacher performance is the role of the block and cluster-level resource persons (RPs) in the BRCs and CRCs. These resource centres, set up under the District Primary Education Programme (DPEP) and later expanded through the Sarva Shiksha Abhiyan (SSA), were originally mandated to provide academic support to teachers. However, SSA appended administrative tasks to the list of their responsibilities (TSG, 2010), effectively nullifying their ability to provide academic mentoring to the teachers. Surveys show that, overloaded with administrative work and suffering from lack of recognition, these RPs believe they have been reduced to the role of "powerless cogs in the machine" or paper-pushers. (Aiyar, 2018) (TSG, 2010) The

consequence is that monitoring and mentoring run without a clearly stated objective or goal (Bhatty & Saraf, 2016).

These realities, compounded with the changing pedagogical requirements of the day[2], highlight the urgent need for in-service performance enhancement of teachers, sustained supportive supervision, well-defined operating procedures and organised monitoring processes to support the various quality improvement endeavours.

B. Technology – The Silver Bullet?

With the proliferation of smartphones and high-speed internet in India, and the huge amounts of money being poured in by technocrats[3] all over the world (Narayan, 2018) (Burton, 2012), countless technological 'solutions' have been implemented over the last decade. While most work directly at the level of students under the guise of 'EdTech' (such as Mindspark or Byju's), various NGOs offer tech development services to the state departments to create Management Information Systems (MIS) to streamline data collection processes and assist in planning. We restrict ourselves to the latter in this paper.[4]

Working with state level authorities, this approach ends up being a top-down implementation of technology with the economic production function model (Rampal, 2018) at its core – it assumes that a change in the input (data collection) will cause a correlated change in output (student learning). Here, the system often assumes a punitive role by setting monthly targets for school visits, using geo-fenced devices and CCTV cameras to ensure consistent and authentic data collection[5] (Rampal, 2018) (Sharma, 2019) (Rampal, 2019), thus losing the field agent's (ABRCC/CRCC) agency and the beneficiary's (teacher) local context. This leads to low motivation, as the field agents do not see a purpose in the task (Bhatty & Saraf, 2016).

In most parts of the country, data tends to be collected for the sake of appearing to be data-driven. The huge volumes of data collected is often inadequate, irrelevant or, being binary (using Yes/No responses) offers little insight into the causes of the recorded behaviour/process or the way forward. Moreover, the flow of data tends to be only upstream from the field to the administration. The field actors (ABRCCs/CRCCs/teachers) never see their own data again. This causes a two-fold problem – inauthentic data is filled in owing to the thrust on meeting targets and absence of sanity checks; and the data is never used for

quality improvement processes at the local level. In its extreme, this leads to situations where the state departments approach external experts with requests to the tune of – "We have a lot of data, please help us do something with it."[6]

Thus, monitoring has been reduced to data collection, and academic support is in absentia. Overall, the issues with data-based monitoring include:

1. Lack of motivation to engage in academic initiatives
2. Unclear target-setting and operating procedures
3. Limited knowledge of academic problems and contextual solutions
4. Unspecified reasoning for data collection processes
5. Unsure usage of technology
6. Absence of need-based academic support, and
7. Inability to provide on-site support owing to geographical scale

Part II: The Solution

A. TELOS – Motivation by Design

Project Background

It is to address the issues mentioned above that Ignus Pahal, supported the State Project Office, Samagra Shiksha, Uttar Pradesh, implemented in 2018-19 a project called TELOS (Targeted Enhancement in Learning Outcomes through Supportive Supervision) in 8,259 primary schools of five districts – Agra, Bareilly, Gautam Buddha Nagar, Prayagraj and Varanasi. District and Block Resource Teams were created to further train all the teachers in their respective blocks. To mitigate the usual transmission loss owing to cascade, TELOS utilised a 're-construction' method, wherein each team re-created the training as per local context, resources, and needs. As each level assessed all levels below it in the cascade, the observation data collected was analysed centrally by Ignus Pahal and the report shared on a fortnightly basis. Using this data, the teams would plan their field activities in a need-based manner. The DRT and BRT members received inputs from Ignus Pahal in a consistent manner through interaction in workshops, WhatsApp groups, or over the phone.

Project Approach

The problem being addressed is one that of generating motivation and enhancing performance. Research indicates that external motivators like financial incentives often do not work (Muralidharan & Sundararaman, 2011). Our experience shows that increasing the chances of teacher success improves motivation. To this end, we make use of performance indicators (PIs) as the central device for triggering change.

These PIs when elaborated with descriptors (see Table 1: Sample Teacher Performance Indicator) allow objective measurement of performance – thus offering a breakthrough in converting qualitative processes into quantifiable data as the supervisor becomes an informed observer. This data can then be aggregated and functionaries responsible for helping teachers improve their classroom processes can identify the nature of support needed. Thus targeted support is provided to the right region in the right domain instead of a general one-size-fits-all approach.

At a more local level, PIs act as a raw material that take a final shape when connected to a specific teacher since each person performs differently on the set of indicators. Individuals can thus examine their own teaching process and set meaningful improvement targets for themselves.

1. The teacher creates an equal and encouraging learning atmosphere in the classroom.			
Level 1	Level 2	Level 3	Level 4
The classroom is very quiet. Only the teacher speaks. Negative remarks are made about students when they are unable to answer correctly.	The classroom is mostly silent. Only a few students speak. There is no interaction among the students themselves.	The teacher has a smile on their face. Students do speak from time to time. They are engaged in oral activities in large groups.	The class has a lively environment. Each child has the freedom to speak. Students raise questions and make suggestions. Audio-video content is used. Each child encouraged to speak.

Table 1: Sample Teacher Performance Indicator

Extending the idea of motivation along the chain, performance indicators were developed for CRCCs and members of the block and district teams as well. This allows a collaborative shift, a shared responsibility in a documentable, shareable manner without physical presence. Inferences from analysis of recorded teacher performance, along with improvement suggestions, percolated down the supervisor chain from district to cluster level thereby creating a cooperative peer structure as the observation, support and trainings were all done by the BRT/DRT members who themselves were teachers, HMs, CRCCs or BRCCs.

The approach also allows short-term (e.g. monthly) improvement targets to be set at each level. This builds on the Theory of Small Wins (Weick, 1984) – i.e., concrete, minor improvements that by themselves may appear to be unimportant but strung together can generate motivation to take on larger challenges and make them more achievable. (Rog, 2015) The tech releases to the teacher, via the supervisor, a kind of drop-by-drop shift in performance tailored to that teacher.

Each rung in the ladder holds the responsibility of delivering an improved performance in all levels below it. Extending this further upwards, the whole programme is premised on the fact that the support agency, i.e., Ignus Pahal, delivers an improvement at the district level. This puts our own skin in the game and creates a shared responsibility of failure and success.

B. Adapting technology

TELOS was a complex programme in its overall design but was straightforwardly simple for each implementor. It is important to understand that there are two interlinked design elements: the outer design – the UI/UX of the technology; and the intrinsic design, i.e., the motivation for using the technology.

All data collection and analysis efforts were preceded by a perspective-taking exercise to answers the following questions:

1. How can data collection be made easier for the user?
2. How should the data analysis be reported so that the implementor can quickly convert it into action?

The first requires an understanding of the user behaviour. Based on qualitative data and feedback, a rough user profile was constructed. For example –

- Users (ABRCCs, CRCCs, teachers) do not like downloading apps. This is reasonable since the system requires them to use their personal property (smartphone) for official purposes.
- They often lack high-speed internet access in the field.
- They use only a limited functionality of their smartphones. Since they rarely ever use the web browser, they tend to mistype URLs.

Traditionally, in the development sector, the user has to accommodate to the application. This creates the need for organising 'how to use the app' workshops.[7] This is a bizarre idea since for nearly every app that the user uses regularly (from Facebook and YouTube to Candy Crush and TikTok), s/he never needed to attend such a workshop. How is it that they are able to display great proficiency in one scenario but struggle in another? Simply put, apps like Facebook employ dozens of psychological tactics to simplify access and amplify engagement

(Benartzi, 2017) (Thaler & Sunstein, 2009). In our endeavour to generate user ownership we eliminated this unnecessary workshop from our setup.

With this background, we focused on –

1. Simplifying the survey form.
   To minimise the effort on data entry, we rigorously vetted the list of data points to be collected to remove redundancy, and optimised the interface of the form keeping the user profile in mind.
2. Making it easy to access.
   A one-stop landing page (see Figure 1: Screenshot of Landing Page) containing all information and protocols related to the programme was developed to create a hiccup-free workflow. This link once opened in the web browser can be saved as an App icon on the phone thus leveraging the power of web technology without having to install an application.
3. Making it worth accessing.
   This ties with the larger of aim generating motivation – giving the user a reason to use your service. While the design of the data collection processes plays a pivotal role in this endeavour, the glamour that technology brings cannot be underestimated. Two instances of this –
   a. Field implementors feel pride upon seeing their name prepopulated in the survey form – a feature originally imagined for the purpose of keeping data clean and the form easy to fill.
   b. Using a live polling service to collect day-end feedback from workshop participants made it an interactive, enjoyable exercise allowing authentic data to be collected rather than traditional “all good” responses.

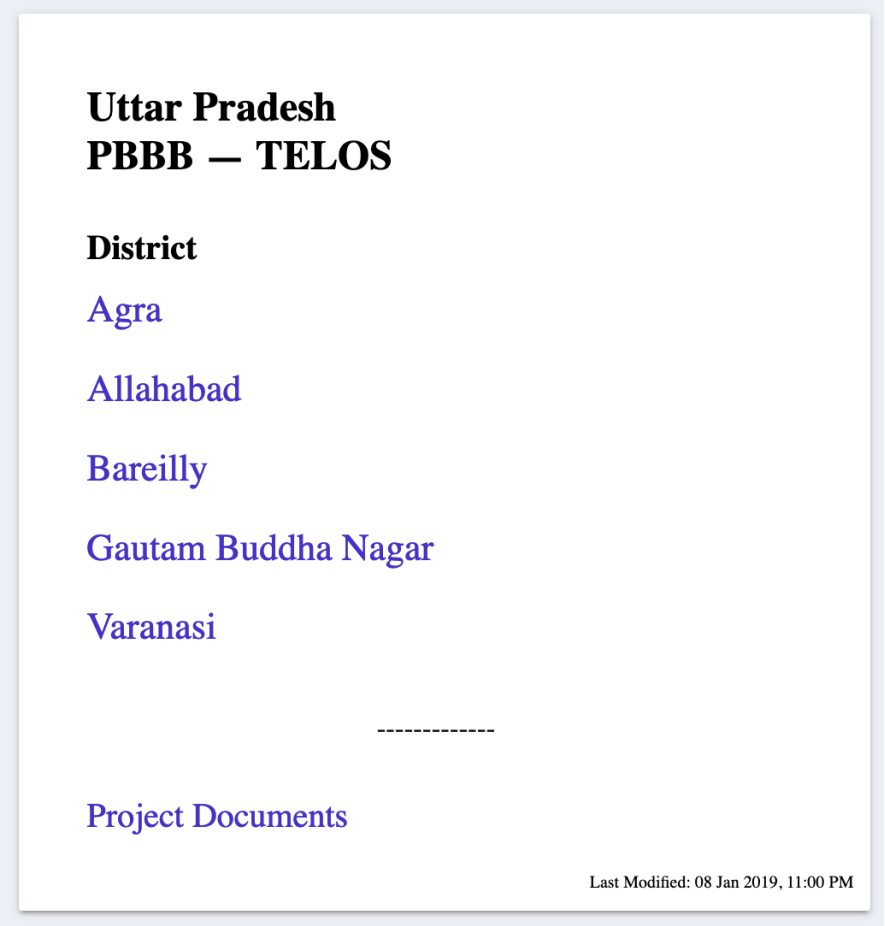

Figure 1: Screenshot of Landing Page

However, making data collection an easier, more efficient exercise is not enough. It is important to ask: why collect data? To quote Karl Pearson:

"When performance is measured, performance improves. When performance is measured and reported back, the rate of improvement accelerates."

This statement, known as Pearson's law, has been around for over a century. Unfortunately, in the education sector the second, and more important, half of this statement is not emphasised enough. Most of the vast amounts of data collected by the system every day is not reported back or used for planning efforts. (Bhatty, 2019) In machine learning (which is based on how human learning works) – the machine can improve only if continually fed the delta[8] of its output against the truth/expected value. If the feedback loop does not close, the only way the machine can improve is random chance. In the education system, with real lives at stake, it is imprudent to leave matters to chance.

In TELOS, therefore, feedback recorded using mobile-based data collection services in near real-time across the state, was centrally analysed and shared with local actors responsible for relevant next steps (DRTs and BRTs). The objective went beyond returning the data in an aggregated form, to establishing an understanding and eventually a desire for seeking data-based approach to educational interventions. In most cases, the users are likely first time data interpreters. To them, line graphs, bar plots and pie charts are intuitive. Other formats like area graphs, bubble charts and radar charts, not so much. The users also have very minimal, if any, experience in statistical analysis. Here again, percentages and averages work best for conveying the message. While standard deviations, error margins and p-values are important in their own right, they serve no purpose for the end user.

When the reason of collecting data, the process of collecting it, and the inferences drawn from it are understood by the users, an ownership is generated. This is agency of technology.

Finally, feedback is crucial not just for the field functionary (teacher, CRCC, BRCC) but also for the programme designer (the state, technical support partners). Thus, feedback was recorded from teacher trainings and state-level workshops using similar mobile-based tools. This was then analysed centrally and utilised to steer the programme in a responsive manner. Given the vast geographical and numerical scale at which the programme operated, this data collection and analysis was made possible only by technology.

Results

TELOS is a symbiotic process emerging from the interplay between the larger programme approach and the technological support. This approach utilised the strengths of the existing government system and only optimised its processes in a non-invasive manner. The benefit of this was that the programme was seen as a way of working rather than a one-off project. The impact of TELOS is summarised below –

1. Relationship change: The relationship between supervisors and teachers has improved. In the words of the teachers, they are now "less fearful" of the BRCCs and find that the supervisors at block and district level are more supportive than before.
2. Data-mindedness: Each member of the system had to develop an evidence-based way of functioning in which they were provided supportive handholding. Both qualitative and quantitative data shows how the functionaries developed their understanding of data as they moved from recording data with a positive bias initially to questioning its authenticity and moving towards recording actual data.
3. Responsiveness: In a system riddled with inaction, technology allowed the creation of a responsive mechanism. Implementation of materials, training, and support saw a state-wide common input with a customised local manifestation.
4. Measurable performance: Using performance indicators, we have data to show that the teacher's actual performance in the classroom has changed for the better. Plus, we have been able to connect the change in teacher performance with specific aspects of student learning via baseline and end-line assessments. This was not possible before.

Conclusion

It is imperative to recognise that technology is rarely ever the disrupter, ideas are. In a 'human space' like education, technology can best assist in making processes efficient and eventually effective. Thus, instead of creating 'solutions looking for problems' we need to see technology as offering assistance tools, akin to the printing press. Just because books could be mass produced did not mean that the level of discourse would heighten or literacy rates would jump up. What really matters is the quality of the content being produced.

Our experience with TELOS lead us to suggest that the education system is an extraordinary machinery that needs lubrication in the form of better information systems, a robust feedback loop and clear operating procedures. This would establish a sense of ownership in the field functionaries and thus generate accountability organically. In a diverse and heterogeneous

country like India, the TELOS approach enables the generation of local resources and working frameworks adapted to the context. The flexibility of approach and modular nature of tools allows us to quickly deploy without wasting critical resources on running a situation analysis. Right now our responsiveness is human-based. In the long run, we intend to develop a machine learning based recommendation engine that captures human expertise and further scales supportive input effectively.

From TELOS' 5-district, 8300 school implementation in 2018-19, the education system and all its members found the approach intuitive and appreciated our tools. Various other state governments and NGO partners have displayed interest in TELOS as well. In the year 2019-20, Ignus Pahal is scaling this approach to 160,000 primary schools in all 75 districts of Uttar Pradesh with support from the SSA and UNICEF.

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[1] Among the available public datasets, we will lay our trust in NAS as it is the only dataset recognised by the MHRD.
[2] Increased access has vastly increased the percentage of first-time school-goers, which in tandem with poor PTR manifests a unique multi-grade multi-level situation. This begets a unique pedagogy as traditional modes of management cannot adequately address this.
[3] https://www.livemint.com/Companies/OMnwLYzGCArRAdlblYPFyK/Ashish-Dhawans-CSF-closes-40-million-fund-for-early-educat.html
https://www.jagranjosh.com/current-affairs/niti-aayog-signs-agreement-to-document-systemic-transformation-in-education-1550047641-1
[4] Interested readers can read about 'EdTech' here –
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[5] Using data for punitive action is absolutely unjustifiable and inequitable. Data is for the people and of the people. (Eventually also by them) All personally-identifying information was removed from the data before sharing it with functionaries. The granularity was maintained at a cluster level..
[6] Based on actual incidents with the authors
[7] Surprisingly, even projects supported by top tech companies like Microsoft and Google fall prey to this.
[8] Delta here implies the difference between the calculated response of the machine and the truth value.