Teacher Development in Whole Class Technology Integration through a Design Experiment

A brief status report on the research study in 12 schools of Kolar, Ramnagara and Bangalore

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The research study attempts to unpack the processes involved in technology integration towards a nuanced understanding of teacher development. Recognition of the criticality of the teachers’ role in the classroom in the effective and appropriate use of technology as a means to improve the quality of learning is central to the research. This is in line with findings from studies on technology in education that have shown that improved learning is to be gained from innovative teaching strategies and not merely from equipping classrooms with computers. The research is therefore based on a specific kind of technology innovation that is designed to strengthen the role of the teacher for improved teaching learning. The 3 year research study is being conducted across 12 government schools in Karnataka, with 24 teachers of Math and Science in grades 5 through 7. Using the framework of a design experiment the study introduces teachers to the technology and in the process, engages teachers in a participative form of teacher development through the use of training, onsite and online support while simultaneously studying the processes of teacher change. Initial findings provide key insights on the potential components of teacher development in general and in technology integration in particular, viz., reposition innovation (in this case, technology) as a symbol of change, acknowledge teacher beliefs about teaching/learning, validate and build on rather than challenge current practices, address content pedagogy issues, and promote teacher autonomy, decision making and reflexivity.

Background and rationale:

The goal of the research study is to develop a nuanced understanding of teacher professional development in whole class technology integration using the methodology of a design experiment. It is now well documented that technology has failed to bring about the transformation of teaching learning in the classrooms that it was purported to (Becker, Ravitz 2001; Cuban 1993, 2001) not just in contexts plagued by poor infrastructure but even in resource rich contexts. The burden of blame for this often falls on the teacher who is seen as resisting or unwilling to adapt to the change that is sought to be achieved. It is true that teachers are suspicious of innovations in the classroom but not just because they fear the extra work it might entail but because they are unconvinced about the utility of the innovation in aiding the teaching learning process. Even more pressing perhaps is the fear of not having the means to cope with the demands of the innovation and consequently failing.
Research over the years has shown that teachers’ fears in this regard are in fact well founded. Efforts to introduce technology in classrooms often begin and end with training teachers in the use of the same assuming that integration will somehow be achieved (Sandholtz 2004). Although there is enough evidence to show that the issue in technology in classrooms is really one of integration, there are very few studies that have actually tried to unpack the term integration and understand what it actually entails in the classroom (Lawless and Pelligrino, 2007). Studies have also shown that popular notions of interactive teaching are difficult to sustain in real classroom conditions and that teachers who are faced with the challenge of maintaining pace and allowing for student contributions, end up becoming more and more directive (Brown 1992). The issue with most teacher development efforts is also that they tend to focus on pedagogy in isolation, not recognising that in practice it is linked inextricably with subject knowledge which is often not addressed. It should therefore not be surprising that, faced with the challenge of a new and often alien technology, cursory training, little or no support with classroom processes combined with less than adequate content knowledge, teachers struggle and eventually give up on the new initiative. This study takes cognisance of the above, accords centrality to the teacher and her/his pedagogy and repositions technology as a symbol of change and a point of entry for teacher development.

The Research:

The technology employed in this research is broadly termed Whole Class Technology (WCT), which refers to the form of technology meant for the whole class or in other words, equipment and software designed for use by the teacher in the classroom in a ‘one-to-many’ format (as opposed to the ‘one-to-one’ format of the computer lab) in keeping with the key principle of the research, namely, the teachers’ centrality. More specifically, the WCT equipment consists of a laptop, an LED projector and power back up and the software consists of short duration videos, viz., Bharatiya Vidhya Capsules (BVC) and Designmate education software (DM) which are specially designed for use by the teacher as deemed appropriate for her class.

The research proposal of the 3-year study was peer reviewed.
by Prof. Punya Mishra of Michigan State University and approved by the Research Council in October 2011. The research was rolled out on in November 2011 after nearly 3 months of intense ground work for a period of 3-4 months to gain support from government functionaries culminating in a MoU with the DSERT. Officials at the district level were briefed about the goals and objectives of the project and their support was sought. Head teachers of the participating schools were oriented about the details of the project and were encouraged to lend their full support to their teachers in implementing the research. 12 Government schools spread across the 2 districts of Kolar and Ramnagara and Bangalore rural were selected through a rigorous process of school visits and interviews with Heads and teachers to ensure their commitment to the project. Extensive groundwork was done Baseline data on teachers was collected through a survey where teachers’ current practices were captured in addition to video documentation of classroom practices (see annexure). Baseline student assessment was conducted using specially developed assessment tools to assess performance of students in Math and Science. As shown in the table below, the performance of students of class 6 and 7 was quite low at 28% and 36% in Math and 20% and 24% in Science.

![Baseline Student Performance Table]

**Teacher Professional Development:**

Teacher professional development that uses an embedded approach of integrating technology with pedagogy is central to the research. This encompasses an iterative process of assessment of teachers’ current levels based on their pedagogic practices and, designing and delivering need based capacity building through a combination of onsite and offsite training and support programmes in a phased manner.

Phase I: To begin with the 24 Math and Science teachers of classes 5-7, from the 12 schools underwent 3 day training in January 2012 where they were introduced to WCT in a manner that foregrounded content and pedagogy. They were introduced to the concept of whole class technology integration through live videos providing contextual examples and a framework to develop their own WCT integrated lesson plans.
Photo 3: Teacher Training in Progress

The use of WCT, both equipment and the digital content was embedded within the tasks the teachers were set. Teachers examined the model lesson plans, identified the elements of the WCT framework, viewed and critiqued the demo videos of actual WCT classrooms that were specially created for the training purpose. In subject groups, teachers selected appropriate content from the list of BVCs and developed lesson plans which they presented to their peers for feedback. The beginnings of a learning community could be detected in the interactions among teachers in the course of the training.

Some important outcomes of the Training were,

- Teachers gained familiarity with the 4 elements of the WCT Framework (WCT/ Teacher led / student centered/ Formative Assessment)

- The training offered a live demonstration to teachers that the WCT integration demands foregrounding of pedagogy and content while technology remained in the background.

- Teachers prepared creative WCT lesson plans which they shared with their peer group for feedback. This signaled the creation of a learning community.

Some challenges that could be identified were,

- The limitations of teachers owing to gaps in content knowledge were sharply underlined.

- Teachers’ pedagogic limitations underlined: Mistaking any student activity for student centred activity

- Teachers’ ability to critically asses and use digital content.

- Teachers’ apprehensions about meeting the new demands of the innovation – planning and implementation of WCT lessons.
Onsite support: Post their training, teachers implemented the WCT lessons in their classrooms which were observed and documented on video. Detailed logs are also maintained to capture the dimensions of teacher practice within and outside the classroom. Every teacher planned and conducted at least one WCT integrated classroom with the 4 elements of the framework in the limited time that was available between the training and the end of semester exams.

The key issues emerging from the classrooms as emerging from the videos and log reports can be summarised as follow:

Content

• Contrary to expectations and despite teachers’ initial apprehension about writing WCT lesson plans, they have been quite forthcoming in doing so.

• Teachers have demonstrated their openness to using feedback from peers during training.

• A matter of concern was teachers’ lack of clarity about concepts.

Pedagogy

• There was a distinct attempt by teachers to adhere to the WCT framework in their inclusion of Student activity.

• As emphasized in the training, teachers had appropriately employed additional TLMs for student engagement and concept clarity.

• The issues for concern would be teachers’ mistaken understanding of any student activity to be group activity and formative assessment being mostly consisting of questions and answers.

Technology

• Teachers demonstrated their facility with appropriate selection of content; and relative ease with using the WCT equipment, namely pausing and explanation.

• Teachers have exhibited early signs of critical engagement with the digital content as opposed to uncritical acceptance of it as a given fact.

• The use of digital content in classroom was also found to be meaningful and not merely an add-on or a novelty.
• An area of improvement, again one that is closely linked to teacher subject knowledge is the demand of teachers for further inputs at the concept level.

Sharing Workshop: The teachers gathered for a 2 day sharing workshop in the first week of April where two main objectives were addressed:

1. To set in motion the process of teacher reflection and development. To view and evaluate their own videos and identify areas for improvement.
2. To train teachers on the use of data cards, web search and use of email so they can seek the support of the team of subject experts available in the WCT project.

The classroom videos were shared with the respective teachers and they were asked to evaluate themselves based on the given framework. Teachers exhibited high level of reflection in critiquing their own videos and considered it to be a highly useful exercise.

Phase II: The new academic year began with the second round of training in August 2012 where teachers were introduced to the new set of digital content, plan WCT integrated lessons and seek online expert guidance in academic and pedagogic issues.

Figure 1: Flow of Activities (Nov 11 – Sep 12)
Some important outcomes of the training were,

- Teachers were able to critically engage with the digital content and were able to define specific criteria for selection and use of appropriate digital content
- Teachers planned and delivered demo lessons which they reflected on and received feedback from the peer group
- Teachers were engaged in mock online sessions to seek support on content and pedagogy.

Photo 4: WCT integrated class: planning, demo and peer feedback

Online Support: Online support is being introduced this semester as a measure to considerably strengthen the extent and timeliness of the support offered to teachers and is enabled by the provision of internet data cards to the 12 schools. The support will be provided through a team of subject and pedagogy experts who will address specific challenges, concerns and anxieties of the teachers. Teachers will be provided online access to the videos of their classrooms that will be recorded periodically for them to reflect. If teachers so wish, their videos will be shared with subject experts to view and provide specific feedback. There will be video conferences where teachers could interact with the subject and pedagogy experts to clarify their queries. The web access also has the potential for teachers to come together as a community of learners, network with each other and share the resources such as lesson plans and activities they develop as part of the technology integration. Teachers will eventually be encouraged to extend their activities to include web based resources that are suitable for a whole class technology approach. Overall, the goal of teacher professional development in technology integration is to enable movement of teachers from their current levels of teaching to a more lively, interactive, participatory and engaged classroom aided by WCT.

WCT integration is not a close ended goal of the research but is a means to allow for other forms of subject, pedagogic and technological mastery to develop among the teachers. In view of this, the phase
II of the research intends to follow specific teachers to gain a nuanced understanding of how teachers develop and enhance their teaching learning processes by exploring the following research questions:

- What are the changes that occur in the classroom teaching learning processes as a result of teacher professional development for technology integration? How can these be documented and analysed to better understand the processes?

- What are the specific ways in which teachers interpret whole class technology integration? What are the specific subject and pedagogic challenges they are faced with in the implementation of the same?

- What are the innovations that emerge from the classrooms? How do students respond to these new innovations in the classroom? Are there any patterns/ learnings that can be found in these that could inform the future initiatives in teacher development in general?

**Some preliminary findings/ insights from the research study:**

This is an early stage of the research but there are a few emerging insights that could contribute significantly towards an intermediate theory (Hennessey and Deany 2009) for teacher development in technology integration. The key constructs of the evolving framework are discussed below.

*Technology as a point of entry:* The first construct and possibly one that is central to the framework is the very positioning of the technology (WCT) not as a goal of teacher development but as a point of entry. This has significant implications as it not just alleviates the stress of intimidation that technology evokes but also entices teachers to view it as a ‘symbol of change, offers them a licence to experiment’ (Sandholtz et. al.). Armed with the new technology, the image of the school teacher undergoes a makeover and provides an excuse to relook at ones’ own practice as well. No less significant is the effect of the shift in students’ view of teachers from outdated to savvy.

*Foregrounding content pedagogy:* The second construct emerges from recognition of a large unmet need of teachers for a certain kind of support and professional development. As previously indicated, most teacher development approaches leave specific subject/content areas unaddressed which teachers in turn have issues articulating a need for. By focusing largely on subject/ content areas and pedagogic issues thereof, the research addresses one of the major needs of the teachers it works with. The nature of technology used in the research provides a safe avenue to fill gaps in teachers’ own content knowledge without having to compromise their standing.
Build on current practice: The third construct is the approach to teacher development that, unlike many others, deliberately avoids making learner centred pedagogy a necessary condition. This too has important implications for the research as the starting point of engagement with teachers is based on not questioning but validating their current practice. Teachers who have been part of any teacher development effort are accustomed to having their beliefs on teaching learning challenged and being advised to adopt child centred practices. As some researchers have noted, while comfortable metaphors such as child centred learning and teacher as a facilitator are invoked, the actual role of the teacher remains largely unclear. Teachers often feel invalidated even as they struggle to understand and translate these abstract claims into actual practice. While it is not disputed that student engagement is essential to improved learning, what is problematic is the analogous relationship that is being assumed between a teacher led class and poor teaching learning process. Therefore, the attempt here is to not make that assumption and instead, work with the teacher to help build on, improve and enhance her current practices.

Autonomy and reflective practice: As stated at the outset, the technology is predicated on the centrality of the teacher. The teachers’ choice and decision making are also critical components of the process of technology integration. At every juncture the teachers’ autonomy in deciding the suitability of the content, the need to use the given technology, the manner in which it is to be employed in the classroom is stressed. It is important to help teachers awaken to their role as creators and not mere transmitters of the curriculum. Reflection goes hand in hand with the emerging understanding of their autonomy. Teachers are encouraged to view and reflect video recordings of their own classroom and many are keen to have their recordings viewed by others for feedback.

Learning community: The teacher in the classroom is more often than not isolated from the outside world. What the teacher does within the confines of the classroom remains largely known only to the teacher and with little or no recognition could and often does get by with no more than the minimum of required effort. Enabling teachers to become part of a larger learning community is an important element of the entire framework which the online support community provides. The importance of the validation that derives from having a peer or a content expert view their work and comment upon it cannot be overstated.

The constructs need to be tested in the coming months of the research and interrelationships explored and understood for a more robust framework to be developed. The methodology of design experiment allows ample opportunity for building on these early insights through observation, validation and confirmation.
References


Annexure 1: **List of schools in the research study**

<table>
<thead>
<tr>
<th>S.No</th>
<th>DISTRICT</th>
<th>BLOCK</th>
<th>CLUSTER</th>
<th>SCHOOL</th>
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<tr>
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<td>Kolar</td>
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<td>Vemagal</td>
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<td>GHPS, Gandhinagara</td>
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<td>Varthur</td>
<td>GHPS, Sorahunase</td>
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<tr>
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<td>Vimanapura</td>
<td>GHPS, Vimanapura</td>
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Annexure 2: Some Key findings from Teacher Baseline Assessment

Teachers’ comfort with subjects they teach (%)

<table>
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<th>Subject</th>
<th>English</th>
<th>Kannada</th>
<th>Math</th>
<th>Science</th>
<th>Social Studies</th>
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<tbody>
<tr>
<td>Comfort (%)</td>
<td>31.82</td>
<td>27.27</td>
<td>40.91</td>
<td>50.00</td>
<td>9.09</td>
</tr>
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</table>

Teachers’ discomfort with subjects they teach (%)

<table>
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<tr>
<th>Subject</th>
<th>English</th>
<th>Kannada</th>
<th>Math</th>
<th>Science</th>
<th>Social Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort (%)</td>
<td>22.73</td>
<td>0.00</td>
<td>27.27</td>
<td>9.09</td>
<td>36.36</td>
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Teachers’ self report on majority of time spent on type of task (% of teachers)

<table>
<thead>
<tr>
<th>Type of Task</th>
<th>Explanation by teacher</th>
<th>Discussion in classroom</th>
<th>Question by teacher</th>
<th>Activities by students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent (%)</td>
<td>13.64</td>
<td>31.82</td>
<td>4.55</td>
<td>63.64</td>
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</table>
The design of the research is rooted in the experiences of the Azim Premji Foundation in improving learning outcomes in schools by providing digital content through the computer aided learning programme (CAL). In 2008-9 there was an attempt made to offset the technology integration issues that affected the CAL programme by bringing technology into the classroom, thus enabling a closer engagement of teachers with the technology and minimising some of the technical and logistical issues as well. The encouraging results of this pilot project named Alternative Technology Experiment led to the conceptualisation of this current research project that directly addresses the largely grey area of technology integration and the issues of teacher development that are embedded within it.