

# **Breaking the Intellectual Isolation of the Science Teacher**

## **Reflections from Whole Class Technology Research in Government School Classrooms<sup>1</sup>**

**Meera Gopi Chandran**

*The primary objective of programmes to introduce ICTs in teaching should not be to promote digital technology, but to find a way to address the urgent need to strengthen the knowledge base of the science teachers in a non-threatening manner that does not undermine their dignity, allows them to exercise their autonomy and choice in pacing their learning like any other professional. Experience from the on going Whole Class Technology Research shows that the short duration digital content offers such a possibility for creating a learning opportunity for teachers.*

To begin with, there appears to be atleast in the public perception, a dichotomy between what teachers want and what they actually need. It is generally believed that teachers would like to, and do in fact, get away with doing as little as possible. Having had very little say in what constitutes the curriculum, they struggle to make sense of the conflicting demands made on them. As a result they stay on the safe, tried and tested path, especially since they are fully aware of their position at the very bottom of the educational system's hierarchical pyramid. This cannot be taken to mean that teachers would be immune to a rather basic human need to believe that one's work matters. It is sometimes easy to forget that scores of teachers, despite all odds are doing the best they can and many more feel the need to do a good job.

Given the fact that teachers belong to a profession whose professional status is itself held in question (Sarangapani, 2011), it is perhaps by design that teachers do not possess

<sup>1</sup> This paper is an outcome of the experiences and reflections of this author from an ongoing longitudinal research being conducted with Science and Math teachers in 12 government schools in rural and semi urban areas of Karnataka. The research was designed to understand the process of teacher learning in integrating a certain type of digital technology, viz., Whole Class Technology (WCT) in regular government school classrooms all the challenges that are characteristic of the setting notwithstanding. The research itself was intended to help teachers integrate a certain type of digital technology in their classrooms to make learning more engaging for their students. What emerged was not quite what was anticipated, but was in keeping with what could be expected given the existing conditions of teaching and teachers in general and their knowledge base and professionalism in particular.

the long years of training in an academic discipline that is one of the hallmarks of any profession especially those outside of education (Hargreaves, 2000). Teachers in India in particular, are not expected to have high entry level qualifications, nor are they expected to have a sound knowledge base in any academic discipline. This state of affairs is, as eloquently analysed by Krishna Kumar (2005) owing to the legacy of our colonial past where a knowledgeable, autonomous teacher would have worked against the interests of the established bureaucratic structure and the centralised syllabi and prescribed textbooks.

What is more distressing is that the status of the teacher has remained more or less unchanged till date, as testified by the observations of the Justice Verma Commission (JVC) Report on the “institutionalised *intellectual isolation* of the teacher” and the “circumscribed engagement with pedagogy as mere technique (emphasis in the original) (2012: 12). While new standards for pre and in service teacher education are set for the future by the National Curriculum Framework for Teacher Education (NCFTE 2009) we still need to contend with the fact that a large proportion of the teachers we have in service today are grappling with a situation that is not entirely their making. Poorly qualified as they are not stipulated to have any better qualifications, severely lacking in terms of content knowledge as the training did not go beyond equipping them with a few skills to maintain order in class, knowing barely beyond the grade level they currently teach as they themselves are products of the system they now are a part of. While we continue to battle for fundamental changes to set right the wrongs of years of neglect, it is only fair that we take a more humane look at the plight of the teachers who continue to struggle to make sense of their work. The question here is, are we in a position to provide them the kind of support they need to do their work without compromising their sense of dignity, appeal to their sense of wanting to do better and afford them with avenues for professional learning that helps them perform their work better.

In this paper, I will refer to certain experiences of the teachers that were part of the WCT research to argue that digital technology, at least the kind that was employed in this research, has to some extent been able to provide the kind of support to teachers described above. Given the kind of infrastructural issues that plague most of the Indian schools, technological solutions have come to be viewed with a great deal of scepticism and justifiably so. Past experiences with ICT have, for reasons that are beyond the scope of the present discussion, failed to inspire confidence in any potential it may have to improve teaching learning in any substantial or sustainable way. But our experience here seems to indicate that we have the responsibility of not lumping together all things technological, and therefore regard them in the same light but try and separate those that offer possibilities that do not compromise our core beliefs about what constitutes sound educational practice.

The Whole Class Technology (WCT) Research as the name indicates, employed a

specific kind of digital technology meant for the whole class as opposed to the one-to-one kind of technology that is afforded by desk top computers. There are fundamental differences in the pedagogy, nature of digital content and extent of teacher engagement between the two kinds of approaches. Typically, all classroom based reforms, not just ones that have to do with technology, have tried to overturn the classroom practice from a teacher led to a student centred one. It has been argued that child centred classroom pedagogic reforms have come to signify quality, particularly in the developing world but in practice, the performance oriented pedagogic culture reinforces existing hierarchies and supports strong framing of the curriculum, rather than a weak one as required by child centric practice (Sriprakash, 2010). In cognisance of this view, the digital technology of WCT research was designed to leverage on the predominant kind of teaching that happens in most classrooms that is teacher led and promote gradual movement towards greater student participation and engagement, rather than pushing for radical change in existing practice.

The teachers were provided with laptops with specially designed digital content (DC) in the form of animated videos of 3-5 minute duration each explaining a specific topic/concept in Science and Math for grades 5-7. The content was mapped to the textbook for easy navigation and identification of the relevant ones for a given topic. There were on an average 20-30 such DCs for each unit. There was one set of equipment given to a school to be shared between the two teachers handling Science and Math for the upper primary classes. In addition to the laptop, these schools were also provided with a small LED projector to project the content for students in the classroom and also an UPS for battery backup. Workshops were conducted with teachers to help them familiarise with the technical aspects as well as assess the digital content and choose those they deemed suitable and relevant for their students. Teachers were also encouraged to develop criteria to critically evaluate the content and not accept them at face value.

There were academic as well as logistic reasons for choosing grades 5-7. There is a gradual and discernable progression of concepts from simple to more complex in these grades that provides room for closer analysis. The lower classes upto grade 4 do not have a separate science subject and they were taught in the then newly introduced system of Nali Kali which would be very different from that of the other grades and therefore render the results hard to compare. Through workshops and school based hands on support, the teachers were helped with overcoming their initial fear of handling a high end equipment such as a laptop. Teachers, many of them who were handling a laptop computer for the very first time in their lives, were reasonably quick to overcome their initial fears. What took longer was the shift required to consider the digital content as one among the many resources/ TLMs available to the teacher. They were encouraged to carry the laptops home, peruse the content during their leisure hours and plan for integrating any content that may be of interest to the students and reject any or all

content they deemed unnecessary or not suitable. The intent was to provide teachers a new hopefully resource to add to their repertoire but also ensure they had the autonomy to decide the appropriate use of the resource.

It was noticed in the beginning that teachers would simply use the content in their classroom because it caught the attention of the students but they would be hard put to explain the academic value of the same. Gradually however, one began to notice that teachers were sharing things like, “I learnt something new about the earths’ rotation from the ‘video’, which I did not know before, I shared it in class and my students were very excited to watch the video”. Truth was, the teacher seemed more excited about the class. Another teacher revealed how she was very happy that she could show her students the flow of oxygenated blood and de-oxygenated blood on the video, something that she had never be able to explain satisfactorily before. She would then add, almost as an afterthought, “even I did not know these things before”.

Yet another teacher showed us how she would set up an experiment to measure focal length of a concave mirror but the experiment would fail. She had abandoned the experiment altogether. The digital content explaining the experiment encouraged her to bring the experiment back into the class. Now she shows the experiment on screen and then lets students try it out with the actual apparatus. When something goes wrong she now knows how to explain it. Another teacher revealed how she did not follow a particular concept that was explained in the video and went up to a colleague in the secondary school to clarify her doubts. On probing she revealed that in fact she had put up her Head Teacher to seek clarification as she was hesitant to talk to a senior teacher. There was also talk of discussions in the staffroom around topics or content they found interesting. There seemed to be a new phenomena unfolding here that needed a closer examination.

It cannot be denied that science teachers particularly in the rural and semi urban schools work within severe constraints. They are not just limited by their educational background, they often have to teach science with little or no formal training in the subject, as these decisions are dictated by administrative prudence rather than academic requirement. It would be stating the obvious to even mention the paucity of actual instruction time available to them amidst the various para / non-academic activities they are pulled into with frustrating regularity. To be able first to muster the necessary content and pedagogic knowledge required to teach in a meaningful way and find and invest the time required to help students engage in the kind of deep learning that leads to mastery of a given science concept demands a great deal from the school science teacher.

Professionals in other fields have legitimate avenues available to them to enhance their knowledge and skills, and the disposition to engage in continuous learning is a desirable trait. There is considerable autonomy and self-direction involved in decisions pertaining to one’s professional learning and development. However, when it comes to teachers,

the nature of professional learning is also in keeping with their otherwise low status. It is not an exercise where the said professional has a choice in the matter. Nor does she play a role in deciding the nature or content of one's learning. Instead, it is designed and executed by the state in a 'one size fits all' mode and the learning is premised on a deficit principle of compensating for the existing inadequacy.

The compounded effect of these two conditions, the lack of content knowledge or autonomy is fulfilling one's learning needs, allows little room for teachers to build their knowledge base and expertise in a legitimate fashion. Most teachers with no recourse to any material other than the text book which they then end up transacting in the fashion that we are all too familiar with. Many may go through years of service without ever having been able to admit to the difficulty they may themselves have in understanding a particular science concept or the ways of transacting the same in the classroom. In such a situation, one can very well appreciate the relief a teacher might experience when given access to a material which is meant for her students but addresses some of the doubts she may herself have had. This she can do in the privacy of her home or staffroom and use it as a starting point for discussion with peers or seniors without having to expose her own lack of knowledge. Clearly, the duration of the digital content also held greater attraction for none of them are more than 5 minutes long. Teachers admitted that they had very little time for preparation for a class and in any case the chalk and talk method did not require any.

The research also deliberately downplayed the technical aspects and focused on the content and pedagogic aspects. Teachers were encouraged to think of the content and pedagogic requirements of their classroom and then consider the gaps that the DC can be used to fill rather than think of how to use the available content. 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.). Teachers noted that although they were nervous about technical glitches marring their class, use of the equipment was never a goal and they were encouraged to view it as a tool that would add value to the teaching learning process. It could be seen that, armed with the new technology, the self-image of the teacher underwent a subtle but significant shift to from someone who is isolated in the classroom to someone capable of learning and adopting a new practice. No less significant is the effect of the shift in students' view of teachers from outdated to savvy and the newfound confidence perhaps provides an incentive to relook at ones' own practice as well.

Armed with little more than the ubiquitous textbook, these teachers were emboldened to inject some inquiry into their classes. This seemed like the beginning of what could be a virtuous cycle. What helped too was maintaining the familiar teacher-led format of the class that ensured that the teacher could still control the ebb and flow of the lesson

allowing for a loosening of control in the form of a discussion only to the extent with which she was comfortable.

It is now well understood in education theory that good teaching comes from a sound knowledge of content as well as pedagogy of a subject. The failure of pre and in service teacher education to focus on strengthening teachers' subject knowledge and focus instead on mastery of a few skills intended for classroom control has led to teachers becoming de-intellectualised and rendered incapable of deep engagement with their subject. In addition to this, the increasing pressure on the teacher to engage students in child centred learning as exhorted by every policy document, leaves teachers completely at a loss.

It must be noted here that it is too simplistic to assume that all teacher led pedagogies are didactic in nature and therefore less effective and learner centred pedagogies are by definition constructive and lead to effective learning (Hughes and Longman 2006: 16). One can conceive of ostensibly child centred activities that lack coherence or clear objectives leading to little or no real learning. As Brown (1992:169) observes, "There is considerable evidence that didactic teaching leads to passive learning but by the same token, unguided discovery can be dangerous too." On the other hand, well-executed whole class teaching could be as effective in motivating and engaging students in in-depth class discussions. Perhaps our preoccupation with child centred strategies needs to be re-evaluated and efforts channelled instead towards deep learning of both the teacher and the students.

There also needs to be a rethink the possibilities that digital technology has to offer in the domain of teacher professional learning. One of the greatest fears to do with technology has been its potential to replace the teacher in the classroom. This is a possibility that would readily find favour with some of the arguably influential proponents of the case for making our schools more cost effective. Such arguments are obviously in line with the thinking that is gaining currency not just in India but across the globe, that educational institutions can be run along market principles (Kumar, 2011). A host of studies locate this thinking within the framework of neoliberal policies that have set in motion a specific set of actions, which camouflaged under the language of efficiency, performativity, measurable outcomes and quality (Ball 2003, Mc Gregor 2008, Apple 2009). ICT, the way it is practised today as smart classes etc., is in the greatest danger of furthering the interests of this constituency. Obviously one is well aware and wary of the danger posed by arguing for the use of digital technology in the resource starved classrooms; but the answer does not lie in ignoring ICT altogether either. Even now, the National Policy on ICT talks of providing computers to schools and training teachers in ICT use, a road that has been travelled before with no success whatsoever. It is imperative that experiences of the kind that teachers in this research have had are voiced so as to inform such policies.

What the experience of this research has shown albeit on a very small scale is that we cannot ignore the urgency of addressing the professional learning needs of teachers in service today. This is particularly so for science, as the number of students opting for science has dwindled over the years and there are only a handful of trained science teachers. More and more teachers with no previous training or experience in teaching science are being asked to teach the subject. It is the teacher whose knowledge base needs strengthening if we expect her to truly enhance her status of a professional and it can be seen that digital technology and ICT offers immense potential to achieve this. It is also providential that Science as a subject seems to lend itself rather well to this approach. The overused cliché of empowering the teacher was perhaps never more appropriate than in this context.

The primary objective is not to promote digital technology but to find a way to address the urgent need to strengthen the knowledge base of the science teachers in a non-threatening manner that does not undermine their dignity, allows them to exercise their autonomy and choice in pacing their learning like any other professional. The experience from this research shows that the short duration digital content offers such a possibility for creating such a learning opportunity for teachers. The content employed in the research were not all of similar quality. The first need would be therefore to generate high quality content that teachers themselves should play a role in creating. It was found that the very process of sifting through and selecting good content and rejecting the not so good ones was a learning process in itself as they were required to articulate their reasons for such a decision providing them further opportunity to engage in professional learning.

*Acknowledgement:* I would like to thank my research team members, Santhosh S, Manjunatha M. and Suneetha P. for their invaluable contribution to this research.

## References

- Brown, A. (1992) Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings, *The Journal of the Learning Sciences*, vol. 2, No. 2 (1992), pp. 141-178. <http://www.jstor.org/discover/10.2307/1466837?uid=3738256&uid=2&uid=4&sid=21104089604071>
- Gopi Chandran, M. (2012) A Design Experiment in Whole Class Technology Integration – A Point of Entry for Teacher Professional Development, Paper presented at the Comparative Education Society of India (CESI), Annual International Conference, Oct 10-12, University of Jammu, India.
- Government of India (2012), *Vision of Teacher Education in India: Quality and Regulatory Perspective, Report of the Justice Verma Commission on School Education*, Ministry of Human Resource Development Department of School Education and Literacy, New Delhi. <http://www.teindia.nic.in/Files/TE-India-Report/JVC-Vol-1.pdf>
- Hargreaves, A. (2000). Four Ages of Professionalism and Professional Learning. *Teachers and Teaching: Theory and Practice*, 6(2), 151–182. [http://www.tandfonline.com/doi/abs/10.1080/713698714#.U\\_xupcWSxc1](http://www.tandfonline.com/doi/abs/10.1080/713698714#.U_xupcWSxc1)

- Kumar, K. (2011). Teaching and the Neo-Liberal State. *Economic and Political Weekly*, xlvi, 37–40.  
<http://www.epw.in/perspectives/teaching-and-neo-liberal-state.html>
- National Curriculum Framework for Teacher Education.(2009). *National Council for Teacher Education*, New Delhi.  
[http://www.ncte-india.org/publicnotice/NCFTE\\_2010.pdf](http://www.ncte-india.org/publicnotice/NCFTE_2010.pdf)
- Sarangapani, P. M. (2011). Soft Disciplines and Hard Battles. *Contemporary Education Dialogue*, 8(1), 67–84.  
<http://ced.sagepub.com/content/8/1/67.abstract>
- Sriprakash, A. (2010). Child-centred education and the promise of democratic learning: Pedagogic messages in rural Indian primary schools. *International Journal of Educational Development*, 30(3), 297–304.  
doi:10.1016/j.ijedudev.2009.11.010  
<http://www.sciencedirect.com/science/article/pii/S0738059309001539>