# Combining Advanced Educational Technology with Limited Skill Tutor: Lessons from Gyan Shala Project, India

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## Abstract
*Combining computer and advanced technology-based learning material with low cost, relatively unskilled tutor can make a strong case for its widespread acceptance as a cost-effective alternative to an expensive professional teacher. The paper reports on the key design features of a project in India where contextually advanced technology was combined with a low skill and low-cost teacher to achieve satisfactory educational outcomes. The approaches rely on adopting the Piagetian perspective of learning and adapting Vygotskian perspective in the light of Argyris and Schoon's theory to conceive teacher's role as of a mentor who requires no specialized skills or teacher training. The traditional professional teacher's role in the class is re-engineered by splitting it into three parts, only one of which is entrusted to the class teachers while the other two aspects are entrusted to the back end team comprising designers of learning material and school supervisors. The approach requires ongoing research effort by the backroom players and is contingent upon reallocation of resources away from class-teachers to the supply of learning material and back up teams. A comparable effort would call for rethinking the role of designers of technology material as well as of teachers.*

## I. Introduction
It is sometimes presumed that the availability of computer-based learning technology and material should be welcome for improving learning effectiveness in classrooms. But, this would happen only if teacher-technology combination performs better than the teacher alone does. In most formal school systems, the teachers are well trained and well paid professional group who have evolved teaching schedules/strategies to help children move along the learning curve, without reliance on computer-based aids or technological experiments. The effectiveness of such teaching strategies need not necessarily increase by the use of technology. Unless, the learning schedules are structurally transformed to rely on new technology, and the teachers are retrained, the advanced computer-based technology could appear either redundant or simply a high-cost addition to an existing equilibrium state teaching system. Since transforming teaching schedules can only be a long-drawn and difficult process and is likely to cost a lot in terms of teachers' retraining, the potential of computer-based technology to raise learning levels remains unutilized. An easier path to the acceptance of new technology in the class would be to de-link it from the requirement of a skilled and highly paid teacher in the class. If the computer-based technology could be shown to work even with low cost and less trained tutors, or by the learners working on their own, this would then appear a systemic alternative to the existing arrangement. The challenge then is not to show that technology-professional teacher combination is superior to the professional teacher alone, but that technology & low-skill/ low-cost teacher combination is as effective as a highly skilled and expensive teacher. This paper reports on a project in India where low cost and low-skill teacher-tutors have combined well with suitable learning material to help the children achieve significant advancements in learning. Lessons from this project can arguably

be transferred to western countries in the sense of replacing an expensive professional teacher with a $ 6 /hour earning worker complemented by the advanced technology learning material.

## II. The project

A typical teacher in the Government financed public primary education system in India now has a graduate qualification with an additional two-year teacher training. These teachers are paid an annual salary of around ten times the national per capita income and are regarded to belong to the middle-income category. Many such teachers, however, do not like to work in interior rural areas where civic facilities are missing. Further, due to weak governance, a large number of schools in many rural and urban neighborhoods experience an endemic absence of teachers from the job. The learning standards in a majority of public schools remain very poor and many children remain functionally illiterate even after completing five years of primary education. The teacher salary accounts for around 85-90% of the annual cost in many cases and Indian state is finding it difficult to deploy more resources and expand the primary system to bring all 6-14 year old under the school system. Gyan Shala project has been designed to provide good quality education to children from, poor families at a cost that is sustainable in India. This would have to be lower than the current average cost of government system per child. Given that teacher salary accounts for the bulk of the primary education cost, Gyan Shala decided to evolve an education system that could work well with a low cost, and less qualified teacher. A typical teacher in Gyan Shala school is grade X-XII pass women who normally work on jobs which in the USA would correspond to $6/ per hour jobs such as burger vending, home-cleaning and likes. Given the political economy, such teachers would also be more amenable to work in the settings, i.e. interior rural areas and urban slums, where children from poor families live. To help children acquire desired learning attainments even with less qualified and less expensive teachers, Gyan Shala makes greater use of advanced learning material in the class than is common in typical public schools. We report in the following the system design-management considerations in combining low cost and less educated teachers with sophisticated and expensive material.

## III. Theoretical basis of effective teaching by less skilled tutors

Gyan Shala is based on the Piagetian perspective that children's have inherent capacity to make sense of their experience and convert that into conceptual knowledge, which is largely linked to their exposure to the sequence of experiences and their age. Gyan Shala, therefore, gives to children carefully graded material and the children repeat similar exercise many times over. For example, without introducing alphabets, children are encouraged to write such words 50-80 times whose meaning and pronunciation is known to them and which have been used in the stories/ narration in the class. Over the first year of the school, a set of such words is covered which encompasses the use of all alphabets. Only towards the end of modules, the children's attention is drawn to the relationship between the sounds/spellings of words and of individual alphabets. The numerals are similarly introduced through a repeated exercise of counting the same number of objects and linking it with number shape/sound. Gyan Shala, however, recognizes, in line with Vygotsky [1], that a teacher can help children move faster through the stages of proximal development and creates spaces for teachers to supervise/correct children's work individually, in pairs or small groups of eight. But by an innovative twist, the supervisory/ corrective role of a teacher is so organized that it does not demand from them a capacity to analyze the nature/ source of children's error and to explain how to correct the error. Instead, the teacher simply demonstrates the correct answer. The conception of teacher's role in Gyan Shala is largely of a mentor, who trains the students less in an analytical/explanatory sense but more by repeated demonstration of expertise, which is then imbibed by the students. Though the concept of a mentor as a trainer is posited largely in the context of professional expertise [2], we find no deviation from this theory in recognizing the skill of counting correctly, linking sounds to the script, and linking sounds of alphabets to the word sound as professional skills. The learning process in Gyan Shala thus combines

the use of carefully graded learning material by the children with the supervision support by the teacher/mentor who helps a child recognize and correct the mistake by demonstrating through an example. Since most adults have reading/writing skills and arithmetic capability much higher than that expected from the children at the primary stage, and since demonstration/ practice is far less complex skill than of diagnosis/ analysis, this perspective allows any typical adult to work as a mentor/demonstrator for all such operations that the adult knows without any special knowledge or training.

## IV. Reengineering teachers' role to minimize teacher skill development need

Formal education system demands a varied range of knowledge and skills from teachers. An understanding of the theories of learning and of child-development is critical for configuring learning situations and scheduling learning task. There has to be a mechanism and capability to translate the curriculum framework into a specific class-work schedule with the help of available textbooks and reference material. Last, there should be a mechanism to diagnose the source of a problem that a child is having in doing the work and to work out either alternative work-schedule or provide scaffolding to the child to move through the stages of proximal development. In a typical school, all these roles are performed by the professional teacher. In Gyan Shala, these roles are assigned to a back-end team that designs the learning material, visits school periodically to assess and diagnose the causes of children's progress and designs alternative-supplementary learning material and strategies. The team explains to the class-teachers how the material is to be correctly handled in the class. The role of a teacher in the class is then confined to keeping order, assigning material to the children and demonstrating the correct use, monitoring the individual mistakes, and then again knowing the correct procedure. An intermediate tier of a class supervisor is created who visits the class once a week, checks if the teacher is correctly following the schedule and method of teaching specified by the material development team, and helps the children who need special assistance. Gyan Shala, thus, reengineers the traditional teachers' role by splitting it into three units, one handled by the class-teacher, another by the supervisor and the third by the material development team. In the reengineered role, the class-teacher herself should be capable of only correctly doing and demonstrating the work that children are expected to do. The teacher is not an analyst/ diagnostician or designer of children's learning process, but only a skilled person who has the language and numeric skills higher than that of children. Since a typical adult who has gone to a school up to grade X typically has this level of skills, no additional expertise need be developed in the teacher. What is then needed is the class organization that allows such teacher/tutor to see the work practice of each child individually, and to demonstrate correct practice to an individual child when he/she is found to be in error. If this repeated and linked to graded material, which the teachers are told to follow as per guidelines, they are able to perform their role as a suitable mentor without significant training input. What remains important for such a teacher is to have behavioral skills to handle a group of energetic young children, which fortunately society imparts to a large number of adults.

## V. Maintaining responsiveness to children's learning difficulties with re-engineered teacher role

It could be postulated that in a pre-designed role of teachers, which has limited scope for on the spot analysis and diagnosis of children's learning process, the teacher would fail to respond to children's real-life problems that could not be anticipated by the material development team. The research of classroom practices has shown that a typical child-teacher interaction lasts for 0.5 to 2 minutes. Further, a majority of child-teacher interactions in the class relates to order-keeping administrative tasks. The level of energy of 30 odd children in a classroom tends to overwhelm almost any teacher, leaving her little space for undivided attention for any single child in stretches for more than 2-3 minutes. The presumption that such interactions could entail any more than teacher demonstrating correct

method/answer is questionable. Further, the re-engineered teacher role is pre-designed to provide time-slot for explicit interaction between each child and teacher for 2 minutes each day. Gyan Shala experience suggests that for the class as a whole, this can be more child-responsive than the spontaneous unorganized interaction between the teacher and the group of 30 children.

## VI. Higher resource allocation for learning material

Even in most western countries that are not regarded resource-poor, the relative share of learning material in a typical schools budget is less than 15% while the teacher cost amounts for around 85%. In Gyan Shala, the budget allocation for learning material is almost two times the cost of the teacher. Though very high in a proportional term, the expenses on learning material per child in Gyan Shala is almost comparable to the cost of learning material in an elite private school in India, whose monthly fee is comparable to total annual cost in Gyan Shala.

## VII. The centrality of ongoing class-based research by the material development team

Gyan Shala approach works well only if the graded learning material and sequences are designed carefully to match children's capacity to learn at their particular stage/age and to make ongoing correction- improvements in these if children are found to not progress at the desired pace. The ongoing analysis of student-teacher interactions in the class by the material development team is integral to the process. By keeping the record of problems that children face in the given learning task, the material development team evolves the explanatory and corrective role of the teachers. These are detailed out in advance and the teachers are prepared to perform the role as per the predetermined script. Another aspect is to match the graded learning material with both the children's capacity to learn and the socially embedded learning process that children are continually exposed to. Gyan Shala allocates the whole of the first year in the school to count, add and subtract numbers only up to 20, as the students have not had any experience of schooling in the past even though they are 5-7 years old. While introducing numbers and counting, examples of its application in the normal life situation such as counting the bread pieces or the number of siblings, are given. The story text is chosen to include only such words and situations that are familiar to children of the target age group in the concerned social setting. The derived and new meanings are introduced slowly.

## VIII. Correspondence with the agriculture extension services and modern production systems

Gyan Shala design has many similarities with the agriculture extension system. The material development team is like the team of agriculture specialists/ scientists who evolve the correct methods. The children are like farmers who learn correct practice by following stipulated protocols that are demonstrated by the field extension agent, a la teacher's role in Gyan Shala. There is often a supervisory chain to ensure that extension agent-farmer interaction follows the stipulated protocols and specialist team is expected to devise/adapt the protocols based on the field research. Alternately, the role of the material development unit, class-supervisor and teachers can also be seen as of designer foreman-worker chain that characterizes most modern production or service-delivery systems.

## IX. Relevance to the use of advanced technology-based learning aids in the school

The computer-based learning aids are exactly like the graded learning material in Gyan Shala that is designed for independent unaided self-work by the child. Gyan Shala experience suggests that such material can be used as effective classroom technology provided an unskilled adult is placed in the class, whose work is then integrated with the supervision-designer team. The challenge of the designer

of such material will be only to demonstrate that the combination of computer-aids and an unskilled adult/teacher is as effective as a professional teacher. Since the cost of an unskilled adult is far less than that of professionally trained teachers and the cost of IT keeps falling, such a system has a chance to be more cost-effective, as indeed Gyan Shala is compared to a conventional school system. This option would be welcome even without cost-effectiveness trade-off for Science and Math streams in schools where an adequate number of teachers are in short supply. This would require a shift in the way current efforts are allocated while developing computer and technology-based learning devices. The attempt at Media Lab, for example, is to evolve a better match between their designs and professional teachers. Gyan Shala approach would suggest that they could obtain a better acceptance of their products by evolving their use in the absence of professional teachers. They might be better advised in developing the functionaries at supervisory levels while relying on low-cost teacher-tutors.

## References

1. L.S. Vygotsky, *Mind in Society: the Development of Higher Psychological Processes*, Harvard University Press, Cambridge, 1978.

2. C. Argyris and D.A. Schoon, *Theory into Practice: Increasing Professional Effectiveness*, Jossey-Bass, San Francisco, 1974.