Student Learning Achievement Using Multi-Media Tools: A Technology Based Intervention

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Abstract

The study intends to measure the efficacy of teacher training on techno pedagogy and its effect on students learning in academic subjects like Science, Mathematics and Geography. We randomly selected 10 middle schools (@ 2 schools from 5 districts), observed twenty randomly selected teachers and their students over a 1year period and did a learning achievement tracking of students. Measuring tools like achievement test on Science, Mathematics and Geography for class VI and class VII was used to track the learning achievement of students. A baseline and midline study was conducted to analyze the data in terms of percentage. Analysis of the study results shows that the students taught by the trained teachers who used techno-pedagogy in the classroom, have scored a higher percentage of marks than the control group students.

***Key Words**: Teacher Training, Techno-Pedagogy, Learning Achievement Tracking*

Introduction

India, despite its unprecedented growth, faces a daunting challenge in the provision of equitable, quality education that prepares its youth for participation in the digital age. 70% of India's one million public/government schools lack basic IT infrastructure or computer based education and even in schools with technology resources, computer education primarily focuses on teaching 'computers' as a subject rather than as a tool for enhancing the quality of teaching and learning in classrooms. Poor school infrastructure, high teacher absenteeism, a large volume of teacher vacancies, and persistently low levels of learning and achievement all contribute to a staggering dropout rate that sees nearly 50% of young people abandoning their education at the key transitional ages of secondary school. Since 2002, AIF's Digital Equalizer (DE) has been bridging this educational and digital divide by bringing technology to under-resourced government schools across India and utilizing technology to transform teaching and learning into a collaborative, project-based learning approach. The program is creating public education reform by targeting under resourced government schools since 2005. This approach helps teachers to be more effective while motivating and inspiring students to continue their education and open doors of opportunity to higher education and career planning. Features of the program include the following:

I. *Teacher Training*: Training of subject teachers to use technology as a pedagogical tool linked to educational content in classrooms through project based learning. Training encompasses foundations of learning, technology and pedagogy.
II. *Coaching and Mentoring*: working with teachers at the school level post training on how to deliver challenging content, developing teacher capacity to develop their own lesson plans, providing feedback to teachers based on classroom observations etc.
III. *Central Training Curriculum including* a project repository to contribute to and draw upon.
IV. *Creating Agents of Change***:** empowering teachers to create interesting, relevant and compelling content instead of traditional teaching methods of knowledge transmission.

Program Design

AIF's DE program is an education program that focuses on integrating technology as a pedagogical tool to enhance the teaching-learning process in our educational institutions. Targeting children in grades VI-X (the age range with maximum dropout rates), DE provides computer and internet education to teachers and students, and helps teachers to be more effective by implementing project-based-learning methodologies. The program delivery is implemented through an in-house team of master trainers and a group of cluster coordinators. It is expected that each and every teacher who has been part of the DE Program is able to teach the DE way - encompassing the following:

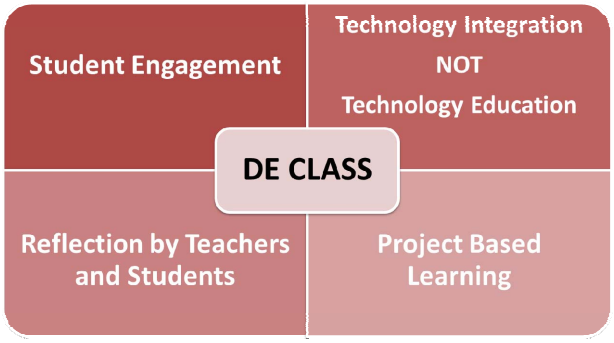

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Figure 1: DE Class

An innovative approach adopted in DE is the use of self-paced learning methodology of flipped classrooms. "Flipping the classroom" means that students gain first exposure to new material outside the class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, through problem-solving, discussion, or debates. The process entails exposing the students in advance during the school hours only. AIF implements the DE Program directly in partnership with state Governments.

DE Footprint

The DE Program, since its initiation in 2001, has worked in 3,207 schools across 14 states in India (94 districts) reaching 8,70,000 students through 56,525 teachers. Presently, the program is active in Delhi, Gujarat, Punjab, Andhra Pradesh, Haryana, Orissa, Tamil Nadu and Karnataka.

Odisha: Local Contextualization

In Odisha, the DE program is delivered through a centralized training model. Teachers are trained at a centralized location which is followed by a monitoring team that visits the schools and provides coaching and mentoring to teachers. The program is implemented in six districts of Odisha in a direct mode in 100 schools regularly visited by DE cluster coordinators and in an indirect mode in 183 schools in the same districts under the monitoring and supervision of the District Project Office (SSA). The cornerstones of the program are the following:

I. *Instructor Led Training Manuals (ILTM):* It is a curriculum module containing a comprehensive 40 hours of content encompassing foundations of learning, technology and pedagogy, delivered over a period of 5 days.
II. *Edukit:* A collection of digital resources comprising of animations, videos, PPTs mapped to the syllabus. It also contains reading materials related to pedagogy.
III. *e-Samadhan:* E-samadhan is a collection of guidance notes, activities, digital content and evaluation questions on selected hard spots. These are provided to the teachers every month so as to guide them in designing collaborative projects and carrying out lab transactions.
IV. *Collaborative Project:* A collaborative project basically focuses on using collaboration as a teaching learning strategy. A teacher selects a topic in sync with the syllabus for the month and thinks through how best to transact the same using all the tools available - technology and otherwise. A meticulously designed lesson plan, micro-plan and guided activities are essential components of a collaborative project.
V. *Lab Transactions:* Lab transaction is using computer & digital contents to teach specific topics, concepts etc. which are in the nature of hard spots.

DE Logic Model and Implementation Strategy

Figure 2 below gives a clear picture of the DE "Logic Model" in Odisha in the simplest terms. In the first phase the district resource group members were trained in each district by the DE team members. This group comprised of the ten selected teachers picked up by the government for demonstrated excellence in using technology in teaching learning, Programmers, Computer Aided Learning (CAL) Assistants, MIS-cum-Planning Coordinators and Block Resource Coordinators (BRCs).

The second phase of the program involves coaching and mentoring at the school level. In selected 100 schools DE team members make two visits regularly on a monthly basis. As part of the visits the AIF DE cluster coordinators guide and help the teachers in preparing their lesson plans, notes, use of selected digital content, preparing evaluation questions for formative and summative assessments and designing projects around those lessons. Thus the focus is on making classroom teaching more engaging and interesting for students through better instructional design. This leads to better learning outcomes at the student level and the overall academic standards improve. There are AIF master trainers (the zonal coordinators) who train the cluster coordinators at regular intervals and make random visits to schools every month to ensure that the necessary processes are in place.

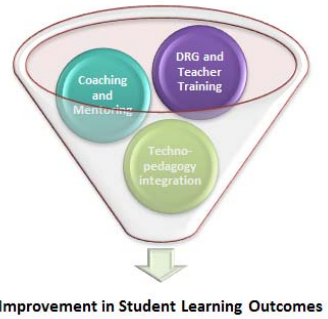

Figure 2: DE Logic Model

The third and final phase "eyes on hands off approach" is followed in the last six months of the program. During this phase the focus is on strengthening the sustainability measures by gradually handing over the monitoring and supervision to the trained Head Masters, BRCs and the DPO. The complete DE theory of change is given below in Figure 3.

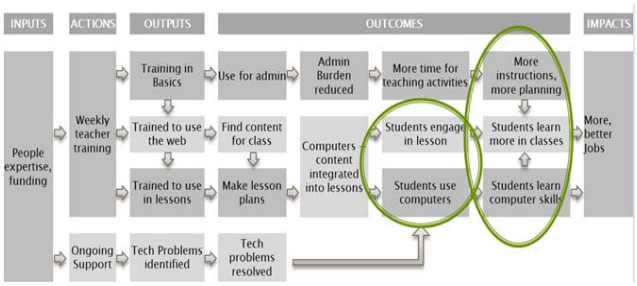

Figure 3: DE Theory of Change

Program Deliverables

The program has distinct well designed deliverables as mentioned below in figure 3 and 4 respectively.

a. Teacher Training

Teacher Training			
Objective	**Content**	**Duration**	**Expected Outcomes**
Better instructional design leading to improved learning outcomes	- Brain-based Learning - Critical Thinking - Creative Thinking - Multiple Intelligence - Collaborative Learning - Project-based Learning - Use of Office tools - Integrating technology and pedagogy (TPACK) - Sensitization on output indicators	5 Days	- Improvement in teaching methods - Improved student learning outcomes - Effective integration of technology, pedagogy and content in teaching learning. - Teachers using collaboration and techniques promoting critical thinking and creativity. - Improvement in classroom activities through group work and PBL. - Increase in classroom participation/Student engagement

Table 1: Training Modules / Teachers

2 teachers were trained from each of the 283 schools spread over the 6 adopted districts. This covers 85% of the Mathematics and Science and SST teachers. On an average each of these Upper Primary School has 4 teachers. The two remaining teachers are trained at the school level by the trained teacher with support of the AIF resource persons.

b. Capacity Building of District Resource Group

Capacity Building of District Resource Group			
Objective	**Content**	**Duration**	**Expected Outcomes**
To orient the district resource group on DE methodology for Monitoring / Supervision & Feedback	- Brain-based Learning - Critical Thinking - Creative Thinking - Multiple Intelligence - Collaborative Learning - Project-based Learning - Use of Office tools - Integrating technology and pedagogy (TPACK) - Sensitization on output indicators	2 Days	Taking ownership and responsibility in implementing the DE Program in all the CAL schools in the district. Monitoring and supervision process will be institutionalized

Table 2: Training Modules / DRG

c. Support at School Level

AIF resource persons visit schools twice a month to coach, mentor and monitor teachers' progress. The process involves the following:

- Helping teachers design technology embedded lesson plans and micro lesson plans
- Project based learning. Ensuring teachers use collaboration as a teaching strategy
- Helping teachers choose and use relevant digital content/ animations etc. and design simple PowerPoint presentations to be used as part of their classroom teaching
- Ensuring that the teachers' pay attention to the bottom 20% students

Objective

To study the effectiveness of teacher training plus coaching, mentoring and its effect on student learning outcomes, in mathematics, science and geography.

Sample

The study sample has two comparison groups. The details are mentioned below.

		Treatment	Control
Class VI			
Number of Students Covered	Pre Test	412	285
	Post Test	315	217
Class VII			
Number of Students Covered	Pre Test	420	300
	Post Test	414	238

Table 3: Sample

Treatment Group: 832 students covered from 10 schools spread over 5 districts during pretest and 729 students covered from the same set of Schools during post-test.

Control Group: 585 students covered from 10 schools spread over 5 districts during pretest and 455 students covered from the same set of Schools during post-test.

Tools

Achievement test tools for science, math and geography developed for grades VI and VII.

Methodology

Non-randomized two group pre-test post-test design has been employed for the experiment. In order to get the exact effect of intervention a pre-test had been conducted among the students. After the intervention a post-test was conducted. For the Treatment group, 10 middle schools from 5 districts selected randomly by lottery method and so also for the control group the same method for selection of schools were followed.

- Pre-test was administered for both the groups before the intervention. Teachers belonging to the treatment group schools were coached and mentored by AIF resource persons so as to enable them to effectively leverage technology tools in teaching learning. Innovative pedagogical approaches such as designing technology embedded lesson plans, micro lesson plans, project based learning etc. were followed by the teachers of treatment schools. Control group school teachers followed the conventional method. A post-test was administered on the topics taught during the study period with both the groups.
- Instructional tools like technology embedded lesson plans, micro-plan, teaching aids in the form of Power Points were prepared by the teachers of the treatment schools. Besides that, the subject specific videos and animations (Edukit) were used by the teachers of the treatment schools as a part of their innovative instructional design plan. Measuring tools like: Achievement test in science, math and geography was used for the students to assess their performance levels after the intervention.
- Statistical techniques such as mean and percentage were applied to interpret the results and 't' value was computed to find out the efficacy of teacher training.

Findings

Efficacy of Teacher Training

Group	N	Mean	Standard Deviation	t-value
Pre Test	167	9.11	3.82	4.55
Post Test		16.23	2.55	

Table 4: Details of Pre Test & Post Test

** Significance at 0.01 level

The results of the table shows that the 't'- value is significant at 0.01 level (t=4.55; df = 166; p<0.01 level). The higher post-test mean score (M1=9.11, M2=16.23) reveals that the 5 days Centralized teacher training based on Techno pedagogy has significant effect on trainees.

Analysis of Average Scores of students

Class VI

VI	N	Test	Science	Math	Geography
Treatment	412	Pre-test	42%	27%	26%
	395	Post test	66%	67%	66%
Control	285	Pre-test	41%	25%	30%
	217	Post test	34%	39%	35%

Table 5: Average Scores VI

Class VII

VII	N	Test	Science	Math	Geography
Treatment	420	Pre-test	41%	25%	30%
	414	Post test	65%	57%	69%
Control	300	Pre-test	17%	17%	14%
	238	Post test	32%	22%	32%

Table 6: Average Scores Class VII

A look at the pre-test and post-test scores across the groups in both the grades show that the Treatment group students have outperformed the students of the Control group.

Discussion

The study shows the effectiveness of teacher training. The 5 days teacher training based on techno pedagogy coupled with regular coaching and mentoring at school level by DE resource persons resulted in learning achievement of students in curricular subjects like Science, Mathematics and Geography.

This program is tightly integrated with the school curriculum thereby improving subject matter expertise through the use of technology. The DE approach focuses on creating a platform for children to think critically, work collaboratively and communicate effectively through a set of Project Based Learning activities which helps children in connecting curriculum with real life situations. Project Based Learning (PBL) is an inquiry based process for teaching and learning based on "exploratory play." Projects often are used to investigate concepts, sub-concepts and hard spots (difficult to explain concepts) from a teachers standpoint. AIF resource persons constantly coach and mentor the teachers at school point by helping them seriously think through and plan out their teaching plan and develop an effective instructional design.

Meticulously designed instructional packages woven around technology embedded lesson plans, micro-plans, technology aided classroom teaching, formative and summative assessments ensure that students develop analytical skills. Students gain a deeper understanding as they are made to reflect at every step of the process. As a result students develop the capability to link from related representations and apply a sequence of reasoning steps in order to solve a contextual problem.

Design-based learning gives the flexibility to facilitate and enable students to synthesize skills from a variety of disciplines and integrate them into learning activities. For example, to solve a problem in environmental science, students might need to employ physics, chemistry and earth science concepts and skills.

It is interesting to note that the highest score in the pre-test is in Science and the lowest in Mathematics. However in the post-test the scores for all the three subjects are almost the same for the treatment group. It is to be noted that the scores in Science for the control group have come down from 41% to 34%. The reason for this being that traditional methods of teaching by the teachers in these schools have failed to provide clarity on the fundamentals, as far as the students are concerned. As a result the students were not in a position to answer the process based questions administered as part of the learning achievement tracking tool.

Similarly in the case of Geography one can see a remarkable increase in scores, from 26% to 66%. This can be attributed to the fact that topics such as change of seasons, rotation and revolution, latitude and longitude deal with a lot of abstractions and cannot be grasped by students without the help of

visual aids. It is precisely the use of these visual aids in the form of animations, videos etc. woven around technology embedded lesson plans and custom designed activities, which enabled the students in the treatment schools to have a grip on the fundamentals which translated itself in a dramatic increase in learning outcomes.

Comparison of the pre-test and post-test results of treatment and control school students, shows that there is an average growth of 31.66% in case of treatment group while in control group the average growth is 12.66%, which shows the efficacy of the DE way of teaching.

Conclusion and Way Forward

A high level implementation plan needs to be embedded within the existing government system in order to be effective. It needs to leverage and build on the existing practices instead of trying to bring about radical changes, which mostly is not required in majority of the circumstances. We have already proved that the DE methodology is a well thought out intervention strategy to leverage the existing technology infrastructure available in the government schooling system in bringing about an improvement in learning outcomes. This is essentially predicated on pedagogy informing the usage of technology – using PBL and collaboration are but different approaches solidly anchored on this pedagogic need.

In order to bring about this change we need to start by training/sensitizing the top level functionaries of the department, teacher trainers and ultimately teachers (who are at the heart of the system). There are three ways of doing this – **firstly** we can directly adopt a few districts where we can do the teacher training, coaching and mentoring at the school level whereas in the other districts the district resource group (DRG) trained by us does the same (a deep cascading). The **second approach** entails becoming a training arm of the government whereby we train the teachers at a central pool and all the teachers in the state are covered. Whether all the schools have computers or not at the moment is not taken into consideration as ultimately all the schools will have computers. The **third approach** draws from both the approaches mentioned above in that while we are the training arm of the government we also have a few districts/schools directly under our program.

In essence the existing government ICT4E policy is procurement driven and there is a felt need in transitioning to an output-outcome based approach. A high level implementation plan / strategy should be informed by this need. Success lies in leveraging the government system, embedding the program within the same and thereby moving up the value chain. This will make us invisible as we are part of the overall mechanism influencing policy formulation and implementation. In helping the existing government systems make this transition we as program implementers undergo a metamorphosis – a change in role from a time teller to a clock maker – fine tuning the overarching system so as to achieve sustainability.

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