

Producing Learning Gains in India through the Group Teaching and Learning Multimedia Hybrid in One Computer Classrooms

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Why develop a Group Teaching and Learning (GTL) Multimedia Hybrid learning system?

As computers and other technologies gain recognition as effective learning tools around the world, there is a growing trend for governments and educational planners to consider introducing technology into schools as a means to improve the quality of education. But the challenges to success in developing countries such as India are great. Faced with stretched budgets and high ratios of students to teachers, those schools that are able to acquire computers may only be able to obtain one or two to be used by up to 60 or more students in a classroom. This is not uncommon. Almost no nation in the world – rich or poor – can afford large quantities of computers for public schools.

The problem of too many students and not enough computers in a classroom works against a key pedagogical strategy of *ensuring every student spends a significant amount of time on task, engaged in meaningful learning activity*. A common adaptation of the technology is for the teacher to sit three, four, five or more students in front of a computer, and usually give little additional guidance. However, most educational software is designed for a user-to-machine ratio of one-to-one or two-to-one. In order to make best use of the software, the teacher and students adapt to the configuration it imposes, one that often does not match the real conditions of many classrooms. This makes it more difficult for both teachers and students to accomplish their educational goals.

Further, while research in developed countries suggests that students can learn effectively through multimedia technology, there is little evidence anywhere that computers and multimedia environments alone can produce educational reform or improved learning. Success is highly dependent upon the design of the software and the ability of the teacher and students to bring the interactivity and assets of educational software into the folds of their existing teaching and learning environment. Intimidated by the machines, the teachers themselves may find it difficult to integrate computer learning into the pedagogy and activities of the classroom on their own,

and may feel sidelined or disinterested in making an effort. If technology is to be used in schools, an easy-to-use method of integrating technology into educational processes is needed which will produce real learning gains.

A small group of education designers at Education Development Centre-India decided to tackle these challenges and produce a method of using educational software that merged many of the features typical of developing country classrooms with the attributes of multimedia computer technology. The result is an innovative teaching and learning methodology that is a hybrid of rich multimedia and pedagogical strategies and is customized to the needs of its audience. It embraces a whole class or group learning environment, supports the teacher and integrates various pedagogical approaches, such as games and competition, familiar characters and songs, local animation and audio examples for students to view, sing and interact with in a large group, on a single computer. The approach is called the GTL Multimedia Hybrid (Group Teaching and Learning Multimedia Hybrid), and it is producing learning gains among primary students in southern India at a cost that is affordable.

A New Series of Learning Game CD ROMs for Indian Schools

With the support of USAID through the dot-EDU T4 project in the state of Karnataka, EDC designers are currently developing a series of science and mathematics learning game CD ROMs that use the GTL Hybrid approach. This CD ROM series targets students primarily in Grades 4 and 5. Three language options are given to the users – Kannada (Karnataka’s local language), Hindi or English – making it possible for broad usage across many states in India.

The pilot CD ROM in the series, *Animal Discovery Learning Game*, was completed in late 2005. EDC designed and tested it, and Sudiksha Learning Systems, a software developer in Bangalore, developed its Flash software programming, graphics and animations. The game was revised based on the results of beta testing in poor Bangalore area government primary schools.

Animal Discovery includes songs and activities that build upon local games and activities and a rich oral and musical tradition inherent in south Indian culture. It helps students learn about

animal characteristics and classifications, building upon the local culture as well as addressing learning objectives based on hard spots in the state curriculum in science.

The second CD, *Ecosystems and Habitats*, is currently in development, also with the help of Sudiksha Learning Systems. Other CDs are in various stages of design, including, *Let's Be Healthy: What is Disease?*.

A One-Computer Classroom Design that Emerges from Interactive Radio Instruction

The GTL Multimedia Hybrid is different from typical educational software in that it designed for a one-computer classroom and serves as a group learning resource for a large group or the entire class, not just for individual students sitting in a computer lab. (Refer to Image 1.) It also builds upon the pedagogical approach of another successful technology intervention tested in developing countries around the world and proven to produce learning gains among large population of learners: Interactive Radio Instruction (IRI). IRI is an activity-based learning system that sets up highly interactive activities which are relevant to the local culture, and which provide teacher or facilitator support.

Daily broadcast of the *Chukki Chinna IRI* series began on All India Radio in pilot areas of Karnataka in the 2004 school year, and broadcast to all schools started statewide in June 2005. These IRI programs cover science, social studies and mathematics topics and target Grades 4 and 5. Integrated into the *Animal Discovery* software design are several useful content, thematic and pedagogical elements from the IRI programs.



Image 1: Students in Grade 4 and 5, playing *Animal Discovery Game*, Agara Government Higher Primary School (School #2)

The IRI characters, songs and style of interactive group learning have become very popular with students and teachers statewide due to the quality of programs and daily exposure. The GTL Hybrid approach utilizes these IRI elements and builds on this familiarity and affection to help motivate, focus and build confidence in the learners. This helps students bridge from the known to the unknown, and adds instructional and aesthetic value to the software.

The *Animal Discovery* game incorporates several elements from the *Chukki Chinna* IRI series:

- Entertaining characters
- Eight topical sing-along songs
- Seven lesson plans for IRI-style follow-up off computer activities
- Five half-hour IRI audio programs

The GTL software uses multiple channels to reinforce learning in fun and engaging ways. The *Animal Discovery* game offers additional activities to enhance and reinforce learning. These include the following:

- Build animals and match their characteristics with animal classes in two team games
- Discuss characteristics using audio-activated lists
- Take competitive quizzes

Most of the activities are accessible from the Menu screen. (Refer to Image 2.)

An Interactive Team-Based Approach

As many as 20 or 25 students can play and learn together with the GTL software when using a standard 14 inch computer screen. The teacher



Image 2: Menu of *Animal Discovery* game showing enlarged mouse-over text

positions the students in their teams close to the computer screen. (Extra large screen objects and text are more visible to users at further distances to the monitor.) More students can participate if a larger-than-standard sized monitor is used to allow for visibility at greater distances. However, classroom management and ensuring maximal participation become more challenging as student numbers increase.

Students are grouped into between two and five teams. While the software does contain supplementary activities with scope for self-guided learning, the highly interactive team game activities are at its core. For example, in the *Animal Discovery Game*, the first team activity is *Build an Animal*, in which teams identify the characteristics of animals by graphically “building” them. (Refer to Image 3.) The second team activity is *Categorize an Animal*, in which teams

categorize animals into classes (mammals, reptiles, amphibians, birds or fish) based on their characteristics. It is a “learn by doing” approach that is also inductive because it allows students to first understand the examples, then arrive at general principles based on how the examples fit. This information is later reinforced when students



review audio-active characteristics lists, and again when they sing

Image 3: *Build an Animal* activity with team indicator in upper left

songs about the classifications. Quizzes provide additional reinforcement. Most actions result in immediate feedback that helps reinforce and clarify information, and gives students continual opportunities for self-assessment.

To move forward in the games, students in teams collaborate to make decisions and act based on information that is presented. Team collaboration promotes peer-to-peer learning and increases the participation of all students. (Refer to Image 4, an example of team collaboration.)



Image 4: School #2 students collaborating in teams

Competition between teams is used as motivational strategy to encourage students to focus on the activity and thus learn better. The combination of collaboration and competition tends to make students pay more attention and try harder than they might otherwise so that they may score more team points. It also tends to make the session more animated and fun.

The teacher plays a crucial role in organizing the teams and facilitating the interaction. The teacher may assign the “mouse-clicker” role to students, and offer guidance in navigation as necessary. The teacher must also facilitate all team activities so that every student experiences substantial levels of interaction with the software and with each other.

Results of the Preliminary Evaluation

EDC is carrying out an ongoing cycle of evaluation on its GTL Multimedia Hybrid software. Recently, EDC conducted a small-scale preliminary evaluation to assess student learning achievements. The effectiveness of the *Animal Discovery* software was tested with students in six schools. This research is part of a broader evaluation study that will extend to a larger sample of government primary schools in Karnataka and address more questions about the impact of GTL software in the context of other learning interventions in schools.

The purpose of this recent study was to find out how effective the software is in helping students achieve learning gains in the given subject area. We also wanted to better understand the relationships between student learning gains and the different methods that teachers use to

facilitate the games. In addition, we wanted to identify the strengths and weaknesses of the software which would help us improve the usability of the design.

Background and Methods of the Evaluation

We introduced the *Animal Discovery* GTL Multimedia Hybrid to groups of 20 students at six government primary schools in the Bangalore area: three that were urban slum schools and three that were semi-rural. All schools had computer labs supplied with at least four functioning computers and 14 inch monitors by the Azim Premji Foundation (APF), although only one computer is necessary to use the GTL Multimedia Hybrid. Students generally attended computer classes between two and four times per week. A computer lab instructor and not the subject teacher usually oversees these classes. Regular usage of APF's series of educational software has made the vast majority of students competent in mouse operation. In each school, we tested a fixed composition of 20 students, split between Grades 4 and 5 and girls and boys, and their subject teachers facilitated the group.

To help us understand the influence of different software facilitation methods, we intentionally did not train the teachers, other than give them very short briefings on the basics of the prescribed team approach. This absence of teacher training most likely influenced the student learning results. Other limiting factors included: a very small sample size that was yet further reduced (refer to the description below in Learning is Achieved), only two activities – Team Games 1 and 2 – were tested (not the numerous other activities available in *Animal Discovery*), it was the first exposure of the students' and teachers' to this game and approach, and the testing in each school was completed by the subjects in one long taxing day.

We collected both quantitative and qualitative data. The quantitative portion consisted of a 20-question multi-choice test that targeted the learning objectives of the two team activities. At the outset of the school visit, before students encountered the software, the test was administered in written and oral forms to the group of 20 students as a pretest. At the end of the day, after using the software, the same students were administered the same test items as a post-test.

The qualitative portion consisted of the evaluation team observing of the students using the software and at least one teacher facilitating. Items on the evaluation instrument focused on the usability of the software, as well as on specific kinds of practices the teachers and students demonstrated. We were able to chart the frequency of these practices for each school later in our analysis. In the focus groups, students and teachers were asked a series of open-ended questions about their opinions of both software functionality and the team approach to using software.

Learning is Achieved

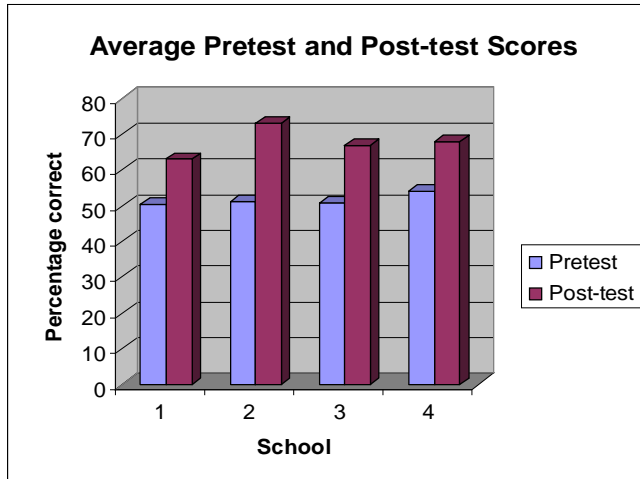
Pretest and post-test scores for School # 6 were eliminated from the study because during its session, a technical problem caused the students to miss nearly half of the content. As was expected, while student learning was achieved, gains from pretest to post-test in School #6 were relatively low, at an average increase of 7.75 percent.

School #5 also had learning gain scores that were artificially low because its average pretest score was 93.3% correct, which is so close to the 100% ceiling that it left little margin for improvement. The average post-test score was 99.8%, showing an improvement of only about 6.5%. School #5's scores were removed from the average overall school gain.

Across the remaining four schools, the difference between the pretest and the post-test scores show an average improvement of about 16%. We concluded that even given the limiting factors stated above, significant learning does occur when students and teachers use this software in the prescribed multi-team style. (Refer to Table 1 and Graph 1.)

School	Pretest correct	Post-test correct	Gain
School #1	50.5%	62.75%	12.25%
School #2	51%	73%	22%
School #3	50.75%	66.75%	16%
School #4	54%	68.25%	14.25%
Overall			16.13%

Table 1: Average percentage of pretest correct, post-test correct and gain scores



Graph 1: Average pretest and post-test scores

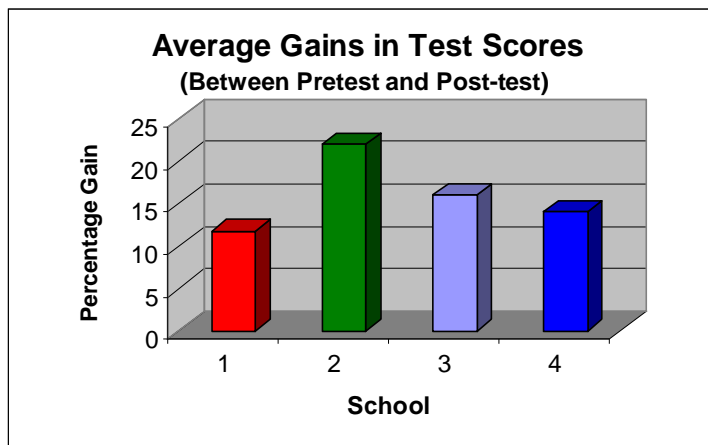
We also noticed that some students showed dramatic improvement on particular test items between the pretest and post-test. For example, in one school, 95% of the students answered one item incorrectly on the pretest, and then on the post-test, inversely, 95% answered the same item correctly. There are several similar though less dramatic examples that demonstrate that the software can potentially help clarify confusion students have on specific hard spots.

Best Practices in Teachers' Facilitation Methods with Group that Enhance Learning

We asked ourselves what might help explain the differences in learning gains between the schools, particularly since the on-screen content remained constant, and the average pretest scores of all schools were within 3.5% of each other (between 50.5% and 54% correct).

School #s 1, 3 and 4 made the respective gains of 12%, 14% and

16% correct, and School #2 stood above with an average increase of 22% correct. (Refer to Graph 2.)

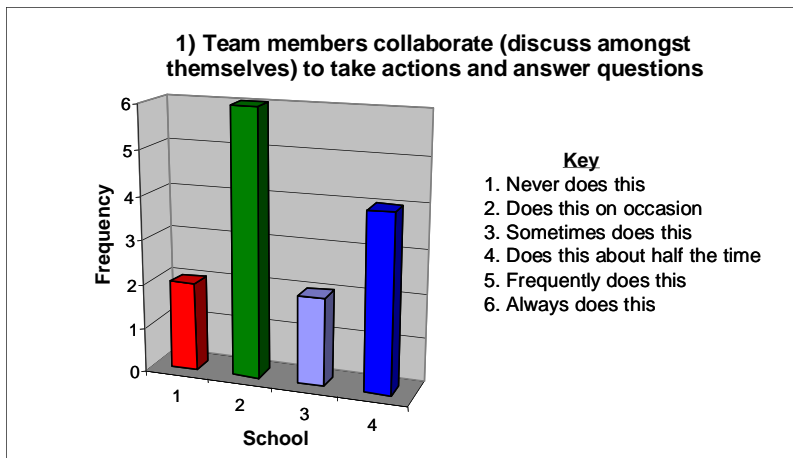


Graph 2: Average gains in test scores

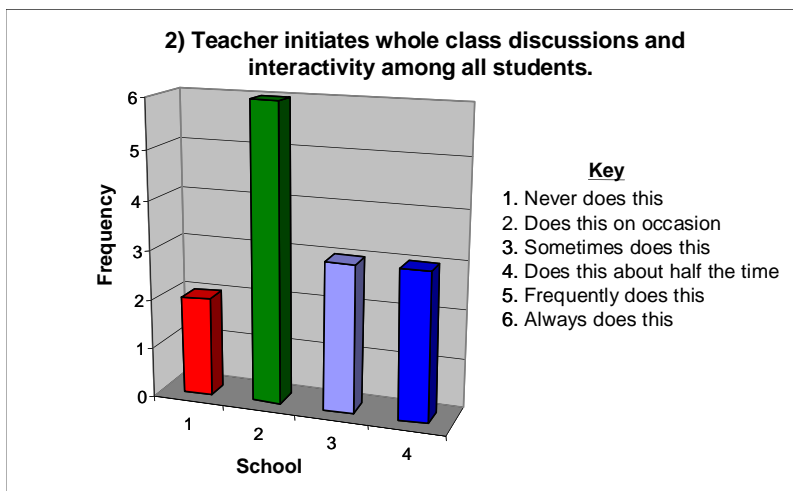
We proceeded to examine our qualitative observations in each of these schools. We looked at particular methods teachers used to varying degrees when they facilitated the student groups. There was a distinctive difference between each teacher in the frequency in which they used three particular facilitation methods. These three methods are the following:

- 1) Team members collaborate (discuss amongst themselves) to take actions and answer questions
- 2) Teacher initiates whole class discussions and interactivity among all students
- 3) Teacher supplements with additional information and feedback to students

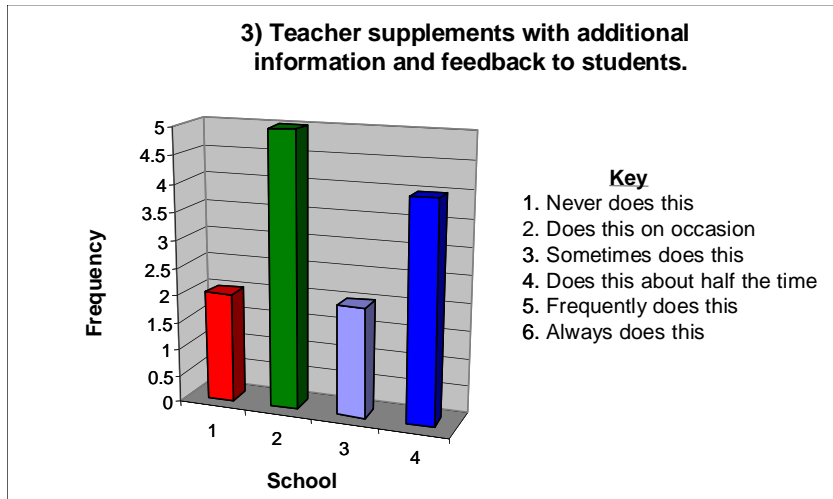
Refer to the observation results for these three facilitation methods as practiced by the four teachers during the software tests (Graphs 3, 4 and 5).



Graph 3: Frequency of use of facilitation Method 1



Graph 4: Frequency of use of facilitation Method 2



Graph 5: Frequency of use of facilitation Method 3

School #2, which had a higher learning gain than the other schools in the study, also showed a higher frequency in the application of the three mentioned facilitation methods. There does appear to be a relationship between the way the software is facilitated and degree of learning attained. This information is being used in improving the GTL design as well as developing the teacher training component.

Summary

The evaluation study, though small in scale and preliminary, has demonstrated that the *Animal Discovery* GTL Multimedia Hybrid can help students achieve significant learning gains, and also be effective at clarifying hard spots in the given topic. The results appear to reinforce the pedagogical principle that learning is, to a large extent, a social activity. Learning can be enhanced if the teacher takes advantage of the software's pedagogical assets as a highly interactive, competitive and collaborative group activity in which peer-to-peer exchanges are optimized so that students motivate and share feedback with each other.

In addition, the GTL Hybrid serves as a teaching support mechanism that introduces to teachers and coaches them in the use of group learning and gaming methods, and it demonstrates to them how to make learning more fun and interactive. Meanwhile, it provides additional support

material for teachers, such as the IRI audio programs and off-computer follow-up activity lesson plans.

One major challenge is to convince teachers that this type of educational software is different from more traditional methods. When computers are integrated into learning, having each child develop keyboarding skills is not the most crucial goal – having the students learn the subject matter and group problem solving is. This is a shift for many technology-based initiatives. Teachers also need to be open to facilitating the activities. EDC is meeting this challenge by making minor modifications to the software that nonetheless should increase the teachers' use of best facilitation practices. EDC is also developing a comprehensive teacher training component to be delivered with the *Animal Discovery Learning Game* copies at the beginning of the school year in June 2006 to schools in Karnataka that have at least one computer.

Challenging Assumptions – Building Bridges

Making technology improve the quality of education in developing countries does not mean that we need to be satisfied to work in small pilot projects or limit computer use to students and schools with large budgets. The GTL Multimedia Hybrid experiment shows that computer technology can produce learning gains and increase motivation if it is compatible with and emerges from the environments and current conditions in which students live and learn. The GTL Hybrid method of using multimedia technology in a group attempts to build bridges and create simple ways to maximize the effectiveness of technology, to leverage proven pedagogical strategies, and customize to the environment joyful interactive learning.

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