

# **POWER OVER CHANGE: HIGH SCHOOL SCIENCE INQUIRY IN INDIA**

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## **Abstract**

The researcher was asked by the Chairman of a private school for girls in India to assist the science teachers at the school in moving classroom instruction towards a more inquiry based teaching method. The prevailing methodology at the school was that of direct instruction. The researcher, along with three undergraduate teacher candidates, conducted a series of demonstration lessons for students to engage in and for teachers to observe. After the lessons teachers from the Indian school were asked for feedback and questions. The study is framed around three concepts: risk, trust, and power. The Indian teachers are risking much in a transition to inquiry based teaching since they are bound to test scores as an indicator of effectiveness in their jobs. The researcher is a well-known figure in the Indian school that the teachers trust. The chairman of the school has the most power in this arrangement since he controls hiring and firing of teachers based on effectiveness measured by standardized tests. The key findings of this study suggest the teachers are willing to move from the direct teaching format in science instruction to an inquiry model, but are fearful of a drop in standardized test scores during the implementation period. Therefore, they would rather keep the direct instruction method that has been shown to generate high standardized test scores thus keeping their jobs. The Chairman wants an immediate move to inquiry teaching on one hand, but without a fluctuation of scores.

In the fall of 2004 this researcher was asked by our Dean of the College of Education to visit India as a favor to a retired faculty member who is active in school policy and practice in the state of Karnataka, India. The faculty member was born in India, but did his doctoral work in the United States. His university teaching experience was all in the United States as well. He retired to India in early 2000. The purpose of the visit was to visit teacher training colleges, to speak when necessary, visit with political officials, and to generally be part of a good will trip. I obliged and my life changed. The culture and the people of India entered my heart.

Fast forwarding to the late 2000's the retired faculty member became Chairman of a school that his father had started in 1967. This school is in rural Karnataka state, India. I received a call and was once again summoned to India.

At first, the visit seemed political in nature, but as I talked with the Chairman it became clear that he wanted my expertise as a science educator and curriculum theorist. The issue at hand was to modernize science teaching at the school to become more inquiry based and move away from the expository model currently in use. I accepted the challenge and have visited the school five times in the past six years.

### **The typical class period**

The school is situated in rural Karnataka state atop a forested hill on the Deccan Plateau. Girls from affluent families from the surrounding area mix with poorer girls from the villages and farms to make up the 850 member student body. All live and study on campus in residential quarters. Day begins with physical training and breakfast before assembly. The classes for the day begin at 8:30am and the girls attend three fifty minute periods before a morning break. Three more classes take them up to 2:30 and lunch. After lunch is a rest period, afternoon sports, and study time before dinner at 8:30 and more study before lights out.

The model of teaching at the school is expository. The students keep the same classroom and teachers come to the students. The students rise when the teacher enters the class and is greeted with, "Good morning Miss," or "Good afternoon Sir," depending. The students sit two at a desk in rows facing forward to a raised platform for the teacher's desk. There are large ceiling fans and open windows with grates. The grating keeps monkeys and other indigenous creatures from entering the school building. Depending on the location of the classroom in the building there are either chalkboards or whiteboards. A few of the rooms have presentation technology, but I have never observed it in use. Teachers have commented that they are comfortable with the technology, but do not plan to use it much due to the unreliable nature of electricity in rural Karnataka.

The typical class period begins with a short review of the previous day's lesson. The teacher will read a paragraph from the text, reread the text as it is written on the board, ask questions requiring the students to respond with a word from the sentence just written, and then the students copy the notes from the board. Questions? Next paragraph. The teacher is in control of the classroom with little input from the students. This procedure continues for a fifty minute class period.

The researcher employed participant observation and interviewing as the major tools of inquiry. The researcher has observed, taught, and

socialized with the students and faculty of the school during the month of June for the past six years. It was a move that none of the participants regarded as strange when the researcher conducted demonstration lessons and follow up interviews with the science teachers.

Data was collected by field notes, interviews, video, and audio recordings. Interviews with the Chairman of the school, teachers, undergraduate assistants, were conducted. Vignettes were written based conversations held with the Indian students.

The analysis of the data was conducted by the re-reading and expansion of field notes and interview data looking for emergent themes in regard to the framework of trust, power, and risk. From this data reduction a matrix was created outlining the relationships of the three key players (faculty, researcher, chairman) in relationship to the three key themes. This matrix was shared with the teachers and chairman for additional feedback.

**What the Chairman wants**

There is an old saying, “The world’s easiest job is knowing how to raise someone else’s kids.” Certainly I never wanted to appear as an expert dictating to the teachers at this fine school what to do. The Chairman wanted me to assume that role.

The chairman of the school was taken by a visit to this author’s elementary science methods class while visiting the United States. He familiarized himself with the National Science Education Standards (1996) and later the Next Generation Science Standards. (2013) He made it clear that his intention was to have world class science teachers at his school and he wanted to teach toward inquiry. This researcher was asked to come to India and work with his science teachers.

Martin (2012) describes the inquiry process as a continuum moving from pure expository teaching through guided inquiry to student directed inquiry. The movement along the continuum also changes the role of teacher from dispenser of facts to co-investigator to observer.

Figure 1

	Inquiry Continuum		
Expository Teaching	Guided Inquiry		Free Discovery
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More teacher directed			More student directed

Figure 2 shows the differences between the methodology currently in place and the direction the Chairman wants to move toward.

Figure 2

	<b>Currently in Place</b>	<b>Moving toward</b>
<b>Principal Learning Theory</b>	Behaviorism	Constructivism
<b>Student Participation</b>	Passive / Regurgitative	Active
<b>Student Involvement in Outcomes</b>	Decreased Responsibility	Increased Responsibility
<b>Student Role</b>	Direction Follower / Listener	Problem Solver
<b>Curriculum Goals</b>	Product Oriented	Process Oriented
<b>Teacher's Role</b>	Director / Transmitter	Guide / Facilitator

This chart is very similar to discussions in the National Science Education Standards (1996) of the changing emphasis of science education in the US. The typical lesson in the Indian school is direct instruction based on a behaviorist model of the teacher providing a stimulus and the students responding. There is also an element of essentialism in the classes since the state syllabus outlines a substantial body of knowledge to be mastered.

The teachers are comfortable with the current model of instruction. Their teacher training has taught them to read the text, write notes on the board, ask students to repeat, and then ask students to copy the notes before moving on to the next paragraph in the text. (I learned this method first-hand by being asked to substitute teach in a biology class in which I had had no time to prepare a lesson. The students in the class, familiar with the method, directed me through how teaching was done in their school.) Repetition causes reinforcement of the concept.

### **Trip One, June 2010 – 21 Days**

The first trip to India was a failure. The researcher planned to undertake class visits, conduct observations of teachers, and present an inquiry workshop, but his time was taken to visit politicians, school officials, and high ranking members of the community. The inquiry workshop was reduced to a mandatory meeting for thirty minutes in the school auditorium. The workshop turned into a lecture with no hands on experience. When it was over the male teachers shook my hand and the women teachers smiled politely and told me how wonderful the lecture was.

The few classes I got to observe had lecture and choral response as the primary method of delivery.

I expressed my displeasure on the political nature of the trip, but the Chairman informed me that education in India has a healthy dose of glad-handing politicians in order to keep funding coming toward the school. It was also revealed that the Chairman expected me to dictate to the teachers how inquiry was to be done and they should do as they are told.

I don't work that way.

### **Trip Two, 2011 – 20 days**

The next trip to the school suggested the teachers are willing to change. As I observed classes there were some attempts to involve the students in discussions, but any demonstration was performed by the teacher with the students as observers. A few teachers sought me out to disclose their willingness to move from the direct teaching format in science instruction to an inquiry model, but are fearful of a drop in standardized test scores during the implementation period. Therefore, they would rather keep the direct instruction method that has been shown to generate high standardized test scores thus keeping their jobs. The Chairman wants an immediate move to inquiry teaching on one hand, but without a fluctuation of scores.

The study is framed around three concepts: risk, trust, and power. The Indian teachers are risking much in a transition to inquiry based teaching since they are bound to test scores as an indicator of effectiveness in their jobs. The researcher is a well-known figure in the Indian school that the teachers trust. The chairman of the school has the most power in this arrangement since he controls hiring and firing of teachers based on effectiveness measured by standardized tests.

Hubbard (2001) identifies three essential factors - risk, trust, and power - that helped her develop and change curriculum and methods in her classroom. To begin the process of change demands the teacher to take a risk with expected outcomes, but in order to engage students and make topics more relevant, the teacher must trust the students to choose significant and meaningful topics. This requires the teacher to relinquish some power as all-knowing director and subsume a co-learner position. These factors are important guiding principles for initiating immediate change in the classroom. However, in order for the change to be significant and lasting other factors have to be considered.

Using Hubbard's work to delineate the power dynamic at the school, charting the trust, based on interviews and conversations, the Chairman trusts the researcher, but has little trust in the teachers' abilities to change. The researcher trusts the Chairman and the teachers. The teachers trust the researcher, but have less trust in the Chairman since he controls the future of their employment at the school.

Figure 3

<b>Trust</b>	<b>Chairman</b>	<b>Researcher</b>	<b>Teachers</b>
<b>Chairman’s Acceptance</b>	x	Trust	Less trust
<b>Researcher’s Acceptance</b>	Trust	x	Trust
<b>Teacher’s Acceptance</b>	Less Trust	Trust	x

Charting the risk involved in moving toward inquiry based science teaching the Chairman is clearly in control. While he has some risk involved with falling standardized test scores he can replace teachers at will. The researcher’s risk is that of credibility with the Chairman and the Teachers, but the Chairman views any failings in moving toward inquiry on the teachers and not the researcher. The teachers are risking the most. They are caught in a “damned if they do, damned if they don’t” situation. If they refuse to move toward inquiry methods in their science classes they can be dismissed. If, however, they embrace inquiry methodologies but their standardized test scores slip they can be dismissed as well.

Figure 4

<b>Risk</b>	<b>Chairman</b>	<b>Researcher</b>	<b>Teachers</b>
<b>Chairman’s Risk</b>	x	Small	No risk, the chairman can replace teachers
<b>Researcher’s Risk</b>	Small risk	x	Small risk of credibility
<b>Teacher’s Risk</b>	Huge risk, could lose employment	No risk	x

It should be noted that the Chairman, although he answers to a board of directors, is seldom challenged in his decisions. His father started the school and was a revered figure in education in Karnataka state, and he is continuing the legacy of his father at the school. The researcher, while viewed as a friend of the school and respected by the teachers and staff has little power over the teachers. The teachers are ultimately powerless in the school. There is no recourse in curricular decisions.

Figure 5

<b>Power</b>	<b>Chairman</b>	<b>Researcher</b>	<b>Teachers</b>
<b>Chairman’s Power</b>	x	Some power over the Researcher	Ultimate power over the teachers
<b>Researcher’s Power</b>	Little Power over the Chairman	x	No power over the teachers
<b>Teacher’s Power</b>	No power over the Chairman	Some Power over the researcher	x

### **Trip Three, 2015**

On trip three I had become exasperated with the process. The teachers described themselves as doing inquiry, but classroom observations suggested otherwise.

“Sir, are students are actively engaged. We lecture and provide a demonstration for them to watch. They are also involved in reading the text and taking notes.”

I had heard this explanation before from student teachers in the United States. As I observed their lesson I noticed the focus of attention was the teacher and the students were passive recipients. But, from the teacher’s point of view the students were actively engaged. This point of view is also echoed by some of my university colleagues who have said, “Students can construct knowledge by sitting and listening.” Perhaps, but I think this only serves to muddy the water when talking about the active nature of constructivist teaching.

### **Resistance and Analysis**

The resistance to change is natural. From the point of view of the teachers this change is fraught with danger. They were taught to teach using a series of techniques that they understand quite well and use to keep the school’s standardized test scores quite high. Students at this school are often highly ranked in the state of Karnataka as well as the whole of India. The teachers do not understand why they are being asked to deviate from a plan that is working.

Whether the activity is expository (low engagement), guided inquiry (teacher directed), or free discovery (student directed), there are ways to help lessen students' apprehension about inquiry activities and strengthen science process skills, as well as helping them learn specific science concepts.

When implementing inquiry in science, keep the following in mind:

1. Pose open-ended questions
2. There will be a great temptation to tell students what to do. Avoid this
3. Practice wait time. Give students time to think after asking questions.
4. Encourage free thinking and exploration
5. Encourage students to describe observations in their own words.
6. Discourage “scientific sounding talk” that may be parroting.
7. Allow students to work together.
8. Let students talk to one another during the activity.
9. Think about how to assess the inquiry.
10. Inquiry can be frustrating to students who always need “the right answer.”

There is a common misconception that curricular changes can happen by decree. If the government, whether in the US or India, decides a change should be put in place schools are generally given a year or two, little or no funding, and minimal support for implementation. I have seen this in my career as an educator many times. The most radical example being schools in the US who wrote grants for computers, received money, spent the money on hardware to have a high computer to student ratio, but had no money left for software. Consequently, save for freeware, these computers gathered dust.

The rub comes for Indian schools since the State Syllabus for Science now is calling for inquiry activities to be included in all science classes. In this way the Chairman is ahead of the mandate. His teachers, though few have implemented, have been aware of inquiry infusion for a few years now. It will be interesting to follow this development and see if what happens to science scores statewide.

### **Assertions**

**The chairman wants immediate change with little professional development and no change (or improvement) in standardized test scores in science.**

This is evidenced throughout our interactions with the Indian school. Changes should happen immediately because the teachers are told to do so. Professional development for the Indian teachers (so far) amounts to a half hour lecture and a handful of demonstration lessons. It is understandable that teachers are feeling pressure to change, conform, and perform.

**The teachers are reluctant to change because they are fearful of a drop in scores.**

This information comes from the culture of the Indian school. Teachers are evaluated strictly on the standardized test scores their students receive. The other factor working in favor of the teachers is that girls in the school who fail to perform well on standardized tests are given probation and eventual expulsion if their scores do not improve.

**The students at the school, beginning with their first science class, need to be instructed in doing science by way of inquiry.**

The school, with its expository teaching methods, has a culture of science being “a basket of facts” to be memorized and spewed back on standardized tests. Once again, change must begin early in their schooling. It has been suggested to the Chairman that inquiry science be implemented first with the Sixth Standard girls and phase the process in over the six years it takes a girl to matriculate through the school. This was greeted as a good



idea, but in the meantime (2013) the State Syllabus for Karnataka has called for the immediate implementation of inquiry methods. Perhaps this will be the saving grace of the teachers at the school since all teachers in Karnataka face the same challenge of implementation and questionable test scores.

Students (and teachers) will need to be taught to think divergently and not always focus on a single correct answer. This attitude is deeply ingrained throughout India and will take years to overcome.

### **Moving forward**

It has been my experience that India produces world class doctors, scientists, and engineers from a population of over one billion people. That fact cannot be disputed. We could speculate and philosophize what the future will hold for future generations of science students in India, but for now, many of us working there will continue delivering professional development in inquiry methods in science teaching to teachers and working to change a system that, frankly, may not need fixing. Some of the Indian teachers have an attitude that inquiry teaching is good for the younger elementary children, but high school students need more expository preparation for college and career. I think for the short run a mixture of methods and a slow integration of inquiry methods will be best for India.

The same could be said for American schools. In my observations I tend to see more expository teaching in high schools and more inquiry in elementary schools. Middle school seems to be transitional with a mix of attitudes from teachers.

For now, we keep working.

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