# TechQuest

*Addressing a Problem of Practice*

*By Rich Edelen*

## Description

The *problem of practice* that I would like to address in my **TechQuest** is that of meeting the needs of all students in an undifferentiated or heterogeneous classroom. Many of my students, and I am sure in any heterogeneous classroom, have varying levels of learning compared to those of their peers. Unfortunately, not every class has the same number of high-level, average, and below-average learners; there is not equal distribution throughout the class periods. Therefore, an educator typically has to choose the group to best address depending on the abilities of the majority, or find some happy medium that typically caters to the average learner in spite of the number of average learners in the classroom. It is my argument, rather goal, to prove that catering to all levels of learning ability in one single classroom is possible; however, the expansion of the classroom walls beyond the traditional confines is an extreme necessity.

In order for this goal to effective attainment, the "typical" classroom lecture, the one with note taking and assessments covering those notes, must be shucked and the teacher needs to become an instructor through a *hybrid* of classroom *discussions* coupled with *idea-based* and *inquiry-based* instruction. Further, the instructor must now find a way to organize the students so that they are capable of learning and helping one another with the instructor/teacher being the catalyst for and supporter of the group. The instructor needs to provide the student groups with a sufficient amount of prior knowledge before asking the groups to take learning into their own hands; however, the instructor should not provide the students with all of the answers.

Furthermore, to ensure success by each student, no matter the level of learning, the instructor must be willing to provide a multitude of opportunities for the groups to participate with one another. This includes class time and making additional office hours available for the groups to meet. Additionally, the instructor can place much of the burden of meeting on the students by allowing for communication using technology and multimedia like blogs, videocasts, and wikis.

By affording students the opportunity to be the learner as well as instructor of their peers, the student can gain a greater breadth of his/her learning capabilities. I feel a student that is capable of explaining a concept to an instructor has just learned the concept. However, a student that is capable of explaining a concept to an instructor, an average student, a less than average student and an above average student has now become educated in a concept.

## Focus

**The Educational Need:**

One critical problem in most classes, though more in science classes, students fail to participate willingly. I am certain there are numerous reasons for their lack of participation, ranging from "*I don't want to sound stupid*" to "*I hate science; it's boring me to death*."

Now the burden falls on the shoulders of the traditional teacher to find a way to incorporate each student in the classroom activities and discussions, in spite of the student's individual ability or desire. The instructor must still provide the students with a good breadth of knowledge of the concepts learned; however, the instructor need not take on the entire burden. Often times in a heterogeneous classroom

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there are students capable of explaining, if not instructing their peers on topics that may be difficult for some students to comprehend.

These students are now capable of becoming peer instructors under the guidance of the classroom teacher. The teacher must find a way for the students of differing abilities and desires to interact within the framework of understanding the concepts taught. Often, group work satisfies this interaction; however, I argue that group work alone is not sufficient. The group must be accountable for the process of learning and understanding as well as demonstrating their comprehension of the subject individually and as a cohesive unit.

Further, the teacher must provide additional material beyond working on problems, handouts, and small group discussions. The teacher must provide resources through various media like video presentations with group discussions in class and online, online simulations that allow changes in quantities to demonstrate changes in state, group forums to discuss recent classroom activities, and unique hands-on activities in which the students are building, or creating, simulations or objects that demonstrate the concepts being covered in class.

**Plan of Action:**

It is my goal to continue to incorporate group-learning opportunities into my classroom. Further, I plan to implement ways in which cooperative education can aid student learning in a technology-supported heterogeneous classroom using group work with and blog postings regarding the use of simulations. Additionally, SMARTboards will aid student learning by providing lessons and examples that students have the ability to record, edited, and re-post online; thus giving seamless integration of the classroom beyond the school's gate.

**Schedule:**

This project is ongoing and has been something I started at the beginning of this school year. As the year progresses, I make observations and note any significant changes that will need to be made to the Plan of Action in the future. I can foresee this project constantly evolving, thus its terminus will be many years from now, perhaps when I leave the education setting. However, no matter the field peer-to-peer, or collaborative learning and working are essential to the success of the organization. So, that said, this project has no true end.

**Common Places:**

- **The Teacher**

  I am providing my students the ability to interact and learn from one another in a safe and supported environment. It is critical that children learn these skills as they will be interacting and working with people, peers or not, throughout the remainder of their lives.

- **The Student**

  Students gain skills in communication, conflict-management, teamwork, technology-integration, and problem solving. Further, students become interdependent upon the comprehension of each other student.

- **The Subject**

  Science and Technology are no longer uniquely different subjects. Each is reliant on the other for propagation and continued growth. Today, student's lives revolve around technology more than

ever before. As a result, technology should also be included in the education of our students across curricula as well as their peer interactions within the classroom and extended classroom.

- **The Setting**

  This project requires no strict setting; however, it is best explained in the traditional classroom and allowed to unfold in the same setting and beyond using digital chat rooms, blogs, and video chatting. Students have the opportunity to work with laptops provided at school throughout the quarter, though they will complete a majority of their work from their home computer. In my situation, all students have access to high-speed internet outside of school.

- **The Audience**

  This intended audience for this project is fellow educators looking to implement inquiry-based learning strategies through group work and technologies such as multimedia presentations, interactive whiteboards, simulations, blogs and wikis.

## Research

The internet research I performed for this project really opened my eyes to the possible effective application of simulations in the Physical Science classroom. In doing so, I explored numerous sites relating to inquiry-based and idea-based learning and instruction, though not all of them were great examples, or legitimate assistance for applying online or electronic simulations in inquiry-based lessons. However, the sites that I did like the most not only described inquiry-based lessons, they also demonstrated that students working through these lessons with their peers in class gained a greater understanding of the concepts being taught as well as seemingly enjoying the coursework a lot more. These three ideas, physical science understanding through simulations, peer-to-peer learning, and group work make a course more fun and; furthermore, is what I have been striving for as a science educator over the past five years of teaching.

My internet research incorporated both Google and Ask search engines. Using Google, I often found myself performing a general search and then remembering to use the Scholar search afterward. I must admit, I Google mostly everything. However, I was determined to find value in additional search engines, so I would use the same Google search criteria or keywords in my Ask searches. Most often, the returns were similar, though sometimes in different orders. Additionally, I used Michigan State University's Electronic Resources to aid my Google and Ask searches.

**Relevant Resources:**

- ERIC – abstract: Enhancing Student Performance through Cooperative Learning in Physical Sciences.
- NSTA – NSTA Position Statement: Science Education for Middle Level Students.
- Inquiry-based Teaching - Relationships Between Inquiry-Based Teaching and Physical Science Standardized Test Scores.
- Wiley InterScience – abstract: The Effects of Cooperative Learning in a Physical Science Course for Elementary/Middle Level Pre-service Teachers.
- National University of Singapore - Center for Development of Teaching and Learning – Peer Learning Strategies.
- Lessons in Cooperative Learning - Schulte, P. (1999) – Working Cooperatively Is A Skill That Must Be Learned And Practiced.
- PhET – Free Online Physics, Chemistry, Biology, Earth Science, and Math Simulations from the University of Colorado.

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- The Physics Classroom – A High School Physics Tutorial with Multimedia and Simulations.
- SMART Technologies – Education Solutions: High-Quality Content and Resources for Every Skill Level.

The above resources assisted throughout the implementation of this project by providing relevant and thoughtful simulations as well as guidance for cooperative work in a classroom setting. The resources address cooperative work at multiple levels of education, but most focus on learning at the middle/high school level.

## Implementation & Preliminary Results

Over the last few years of teaching, I have been diligent in looking for ways to get my students out of their textbooks and exploring the wealth of knowledge they have before them on the internet. However, the implementation of such approach has been difficult on multiple levels. This TechQuest has given me the incentive to push forward and begin gradual implementation of internet-based simulations as well as including online discussions via Microsoft SharePoint covering the concepts covered in class. Furthermore, during classroom discussions, concepts are covered and diagramed, and problems brought forth and solved using a SMARTboard. Using the SMARTboard along with the simulations and discussions allows our class to flow seamlessly from day to day inside and outside of the traditional classroom confines. With the use of the SMARTboard, I am able to post notes online for student access and we are able to continually edit these notes and repost as the discussion continues.

Some of the surprises I have encountered while implementing this TechQuest is the increased desire for students to participate in class. Students receive a third of the period, or 15 minutes, to explore their simulations covering the day's concepts. Then, they receive 15 minutes where they must work with a classmate on a simulation and explain to each other what concepts the simulations address and how this has helped or hindered their understanding of the concept. Finally, the students get 15 minutes at the end of class to search the internet for more simulations relating current, past, or future concepts while I come around and ask each student to explain briefly, what the simulation has taught them. Surprisingly, most of the students I talk with are enjoying the simulations and have concepts clarified to some degree because of the interactive simulation and collaboratively working with their classmates. In addition, some students get a chance to present via the SMARTboard how the simulation is relating to the chapter and the concepts within.

Some unexpected bumps that have occurred during implementation of this project are students getting bored with a particular simulation, as well as jetting off to check their email or attempting to access a social-networking site through the newest proxy servers. I figured breaking the class into 15-minute segments would cut out the boredom quotient; however, some students already have a high understanding of the concepts discussed. Thus, I ask those students to search for additional sites with simulations or interactive explanations of concepts, while documenting their search criteria. I believe asking the students how they search is important for designing internet based projects, as well as getting a clearer idea of how they understand what is being discussed.

I have not had the time to assess how well the use of simulations along with the SharePoint discussions and SMARTboard notes has gone. On April 27, my students received an assessment over this current chapter and I will have a greater idea of how this TechQuest has aided their learning of these concepts. However, I have been able to recognize more interactivity and willingness to interact with others from some of the quieter students as they have been exploring the simulations outside of class and gaining a greater understanding of the concepts. In fact, some of the quieter students are actually participating in the classroom discussion as well as contributing at great length in the online discussions. This brings forth a great point I would like to mention with regard to online participation I have noticed while implementing this project. The students with the less significant understanding of the concepts are typically the students that post to the discussion the most and comment on classmate's posts the most. In addition, for the most part, the students with the greater conceptual understanding are usually the last to post and contribute the least constructively online in spite of their great contributions in class.

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One student actually stayed after class to thank me for this new way of going about class because she is less scared of not knowing the correct answer when called upon. I was very happy to hear she was more comfortable in class.

## Project Evaluation

During my planning, research, and implementation of my proposed TechQuest I learned internet research is simple provided you know what you are looking for and provide the appropriate search criteria. Otherwise, without either of the previously mentioned variables, you will have a very difficult time planning your project. It was critical that I addressed a valuable and pertinent problem in education, but moreover, it was critical I address a concern in my classroom. In my choice for a project, I primarily focused on encouraging the distant student, the student that is the wallflower, to participate more in class and gain a voice in their daily education. I did so by providing collaborative work using simulations as well as allowing my students to continue their classroom discussion online through Microsoft SharePoint. I think I would approach a similar, future project with more focus and detail; however, this will require a considerable commitment beyond the ordinary work and school day. With that said, it is imperative for teachers that are attempting to reach all of their students to put forth additional effort beyond the classroom and work day in order to provide those each unique student with an appropriate level of opportunity for participation, safety, and exploration.

One lesson I learned that I feel all teachers could learn from is that in a collaborative work situation we must provided students with accountability for themselves as well as the group. Each student should be able to communicate the benefits and hindrances they have encountered during their group work without any fear of retaliation from their peers. Given this opportunity, even the quietest, most distant student believes they play a significant role in the well-being and knowledge of the class.

In the future, I hope to refine this project and continue to implement similar learning tools and opportunities for my students. However, I would certainly allow a greater period to establish significant results to demonstrate to my colleagues the importance of technology and the associated tools in the intellectual and social growth of our students. I recall showing my Science Department colleagues a few months back a discussion thread for my classes that showed every student participating in relating avalanches, hurricanes, mudslides, tornadoes, and earthquakes to the current chapter — Gravity, Friction, and Pressure. I was elated that my students, in effect, were teaching one another by correcting each other's misconceptions and disbelief of how the concepts applied to these natural disasters. However, the overwhelming feeling from my department members was "*okay, how is this helpful for me; it just seems like a lot of extra work?*" In spite of my insisting on its ease of use and its educational value, they still have not followed suit, or asked any further questions.

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