FUTUREKIDS

CASE STUDY

Technology Plays a Key Role in Raising Test Scores Through the Development of Higher-Order Thinking Skills

Kentwood Public School District

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As educators, we owe it to each other to share new ideas when we find something that works to improve the learning process. I have discovered something I think is dynamic—and it has helped raise the test scores of students in the Kentwood (Michigan) District.

From 1993 to 1999, our math and reading scores improved dramatically. There are many factors involved in our success, but one stands out in my mind as significant.

Kentwood implemented a very thorough and very successful technology program beginning in 1995, which I believe has directly enhanced the development of critical-thinking or higher-order thinking skills (HOTS) in our students. When students are provided an environment that encourages these skills, improved achievement scores are the natural result.

Kentwood's technology program has directly enhanced the development of higher-order thinking skills in its students.

Higher-Order Thinking Skills

To understand how technology has helped develop students' critical-thinking skills, one must first understand the six levels of learning according to Bloom's taxonomy, which, when mastered, enable higher-order thinking. They are:

1. Knowledge, the acquisition of basic facts.
2. Comprehension, the ability to understand the main idea (like the plot of a book).
3. Application, applying knowledge to real-world experiences and determining the appropriate problem-solving process to use.
4. Analysis, the ability to compare and contrast, differentiating between objective data and variables.

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5. Synthesis, the ability to think independently and creatively to produce a plan or qualitatively improve a product/process.
6. Evaluation, the ability to use criteria (quantitative and qualitative) to make a judgment about something for the purpose of further improvement.

This process is sequential and based on specific learning strategies. It emphasizes the student as a lifelong learner and teaches them how to be producers in life, not simply consumers of information. As producers, students are encouraged to do hands-on work to create something real and tangible, and to continually improve on that work.

Critical thinking is the cornerstone of human existence. The development of these skills should be the primary objective of any educational endeavor. From a far less philosophical standpoint, students who can solve problems, make decisions, participate in planning, and demonstrate analytical skills are the students that businesses seek to hire. Critical-thinking skills have become the number one survival technique in modern society.

We had jobs in the past that did not necessitate problem solving and teamwork, and they certainly did not necessitate the use of technology. As one of the educators on the Grand Rapids Manufacturer's Council, I have had the opportunity to visit local manufacturing firms. All it takes is a walk through the door to see the differences between yesterday and today's work environments.

Today's work environment is quieter, more team-oriented, based on problem solving, and much more technology-oriented. In essence, even the manufacturing jobs have significantly raised expectations regarding employee skill/knowledge level. We need to train all students to adapt to this new work environment—whether they are going right into the work force from high school, into a trade school, or entering a university program.

Kentwood's Technology Program

The Kentwood district is located just outside of Grand Rapids. Over 500 teachers support our 8,600 students, who are spread throughout ten elementary schools, three middle schools, a ninth grade building, and one high school. Kentwood is not a typical middle-class suburb. We are a district on the first ring of the inner city. In our area, we have many families trying to move up in life as well as families that are upper income. Consequently, we have a highly diverse social economic range. As educators, our goal is to provide all these students with the skills and knowledge they need to be able to improve their lives.

In 1995, we partnered with Futurekids, a Los Angeles-based educational technology firm with local offices in Grand Rapids to bring a comprehensive technology program to our district. The Futurekids program includes professional development and integration training for teachers, grade-specific technology curriculum, plus technical support and ongoing mentoring.

Word travels fast in a close-knit community like ours. I had parent groups from different elementary schools coming to me after the first year asking when it would be their turn to receive the lab and what could they do to help speed the process. That only happens when significant learning is taking place. We implemented the program in phases, so it took three years to finally get the labs and training into all of our elementary and middle schools.

We partnered with an outside firm for these services for two simple reasons: economics and efficiency. It did not make sense for us to invest the time and human resources into developing our own curriculum and keep it updated yearly when an excellent one already existed. In terms of efficiency, this program was available for implementation immediately.

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Subcontracting for initial startup teacher training and curriculum simply made the best sense.

We chose to partner with this company specifically because the emphasis on higher-order thinking skills is very apparent in their curriculum. Students perform hands-on exercises on the computer and produce tangible results. Every unit is sequential, based on specific learning strategies. The knowledge, comprehension, and application levels of Bloom's taxonomy are always evident before students make their own product. They are expected to make it better than the example, emphasizing ongoing learning. The ultimate goal—one that we observed within three months—is for students to do lessons in the lab and then apply that learning to other academic areas as well as in their lives.

Kentwood Test Scores Improve

Our state Department of Education developed the Michigan Educational Assessment Program (MEAP) tests to evaluate student achievement. The tests were written to comply with HOTS strategies. This is reassuring to me. Students can not simply memorize answers. They have to comprehend the question, analyze the data, and synthesize that data to devise an answer—just like they would in real life. (We implemented our technology program the same year the state debuted the MEAP testing, so we have been tracking our district's scores along side the progress of the technology training.)

Test scores for fourth grade math rose from 78 points in 1995 to 86 in 1999. Seventh grade reading improved noticeably over those five years, moving from 50 to 55. Our most dramatic results were in fourth grade reading: the scores soared from 59 to 71. It is noteworthy that our district's at-risk population more than doubled during that same time period, increasing from 9 percent to 22 percent. These figures show an obvious trend, which I attribute in large part to the technology program.

Having been an educator for 31 years, I have an awareness of what triggers changes in the way students think. The technology curriculum has absolutely been a catalyst for change in the Kentwood district. There is no doubt in my mind that technology plays a key role in the development of higher-order thinking skills in our schools.

A Learning Environment Based on Higher-Level Thinking

Kentwood students are mastering from kindergarten on, in a sequential manner, the six skills required for critical thinking. In the past, teachers would evaluate student work. We now see students evaluating their own work because they are taught how to do that. Students compare their work to other students. They have more pride in what they turn in to their teachers. They have increased their own expectations and their ability to improve their work. They do this because they are becoming self-evaluators—the highest level in Bloom's taxonomy.

As I walk through our computer labs and see children on task, I see the excitement in their faces and hear the excitement in the noise level. You would think a computer lab would be quiet, but these kids are out of their seats, consulting with their neighbors, practically jumping into the screen because they are so excited about the project at hand.

I see not only the excitement, but also the pride of accomplishment when they produce their own pieces of work. They may be using spreadsheets to display new data they have downloaded or creating a PowerPoint presentation at fourth grade. They are proud because what they are producing is—quite literally—more exciting and engaging than the things they have done before. Their resources are more up to date, analyses more complex, and their products are higher quality.

Kentwood students are excited about taking their projects home and sharing with their parents, too. We often find that

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the student work is better than what a parent could produce. This causes the parents to sit up and take notice, which brings a great deal of self-confidence to the student. I think we would all agree that the most important element for learning is self-confidence. The more confident the learner, the more willing he or she is to take risks. When willing to take risks, learning will increase not in an additive way, but in a geometric fashion, because risk taking is critical to ongoing learning.

These enhanced student skills have led to higher expectations from Kentwood teachers. The students now have the capability to perform at higher levels, and teachers are raising the bar on the quality of work expected. Thanks to technology, students can give teachers a more refined product, one created through the retrieval, evaluation, and synthesis of current data. Their products are better looking too, through the incorporation of graphics and other design elements. What used to be expected of a third or fourth grader has increased significantly in our district in recent years because our students have become much more capable than we ever thought possible.

In the past, when we wanted students to learn about scientific data—say, weather patterns in a different country—they looked up the information, recorded it in their own words, and submitted it as a report. Today, through the use of technology, they can not only look into the weather patterns in other countries, but they can see them as they flow onscreen. Suddenly it becomes not just recorded fact, that lowest level of thinking. It becomes an application of that knowledge—with the student actually seeing these weather patterns happen in real time, analyzing and synthesizing the information, and wondering, "As clouds change formation, what does that mean to the weather pattern below it?"

The millions of "whys" our young, eager children used to ask have been resurrected. For years we have tried to figure out how to keep kids excited about learning. A static report can now become an in-depth evaluation on how weather patterns in one country can potentially affect a whole continent or even the world. And the kids actually get it.

Our students today are taught how to relate to and use timely information. They are, in fact, demanding it. The other thing I find extremely exciting is that students now can compare information much more easily by simply tapping into the Internet. Information is already produced and readily available, whereas in the past much of a student's time was spent looking for information and then putting it down in his or her own words.

Instead of spending time focused on that lowest level of learning—acquisition of knowledge—students are now spending their time on the higher levels—comprehension, application, analysis, synthesis, and evaluation. As educators, we are now able to maximize their time, enabling them to consider what the data means, what the implications are, and how it compares to some other piece of information.

The higher-level thinking skills and drive to succeed we are working so hard to cultivate in Kentwood's students are exactly the same qualities students will need to survive in tomorrow's workforce. Additionally, the technology skills our students acquire today and the additional brain synapses we see happening are expanding the potential of our labs.

In Kentwood, we believe the ultimate learner in life is on a cycle of continuous improvement. They possess a thirst for knowledge, for discovering new things, and for doing things better, similar to a young child. We now know we can help develop that same excitement in our students.

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SCHOOL TECHNOLOGY SOLUTIONS