A Pedagogical Symphony for Technology in the Classroom

How can we orchestrate pedagogy and technology to work together in harmony?

After three decades of failed attempts, we have a new opportunity.

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An Interlude

Let's imagine Ms. Lynn, a mathematics teacher in an elementary school. She is teaching a unit called Different Names for Fractions, which covers the mathematical fact that every fraction can have several names—1⁄2 can be called 3⁄6 or 5⁄10 and so on. Ms. Lynn starts by screening a short animated film from the laptop on her desk, which is connected to a classroom projector. The film shows a trip through a city and stars two appealing young characters, Danny and Benny, who come across a blinking billboard advertising chocolate bars. The class watches with interest, since the students are familiar with the structure of the films and are eagerly awaiting the riddle.

The blinking billboard is advertising candy bars that it says are half regular and half white chocolate, but it shows six squares in a matrix of three by two, with three dark brown squares in different rows. Danny looks at the sign and says, "It says ½ regular chocolate, but the blinking lights show 3⁄6," and Benny says, "No, the advertisement is true." Cut. The question appears, "Who's right, Danny or Benny?"

Ms. Lynn freezes the question on the screen and opens a class discussion. Without rushing to give the answer, she asks the students to open their laptops and begin an activity that appears on every student machine. Called the Fraction Bars Applet, the interactive applet allows each student to build bars of fractions to his or her own specifications and observe that a fraction of a given size can have many names. The applet is engaging and interactive, providing feedback to the students as they work. Ms. Lynn walks around the classroom and helps individual students as needed.

After ten minutes of class work on evaluating a variety of fractions problems, Ms. Lynn asks the students to send their results to the Gallery. She selects the results from two students, George and Nancy, and projects them for the whole class. The students hold a lively discussion in which most of them begin to understand that fractions can have different names.

Ms. Lynn then moves on to the stage of knowledge consolidation. She uses a teaching system on her laptop to provide students with experiential exercises adapted to each individual level of understanding and style of learning. Students then work at their own pace.

Ms. Lynn asks a few students to come up to her desk with their laptops and helps them with parts of the material that they find difficult. She regularly checks the "dashboard" on her laptop, which shows the progress of each student and the whole class in real time. The dashboard signals that one student is struggling, so Ms. Lynn goes over to him for a short conversation and then returns to the small group at her desk.

When the bell rings, the students don't want to go out for recess. They ask to keep working on their laptops.

At the end of the day, Ms. Lynn checks the graphs on her dashboard that show the level of progress achieved by the class and plans the next lesson in the Internet café where she likes to work. She decides to make a slight change in the online lesson plan provided and uses a planning function to reorder some activities and add an exercise she has created using Excel and an online game.

At the end of the month, she runs detailed reports about each student that allow her to plan lessons for the upcoming month and make a formative evaluation of each student.

This is the daily reality in over 270 classrooms in the US and Israel. Time To Know's advanced educational pedagogy works in harmony with a systematic technological solution to empower learning, teaching, and evaluation.

A Discordant History

Teachers in ordinary classrooms in ordinary schools face three insoluble problems that have prevented them from teaching effectively:

- **Difference.** All classes are heterogeneous. Teachers cannot teach every student appropriately with uniform study materials.
- **Relevance.** Children today are surrounded by a digital, virtual, interactive world that fascinates and activates them. In comparison, the traditional classroom is a largely boring and irrelevant.
- **Follow-up.** It is difficult to follow the progress of every student in a class of thirty-five, and it is impossible to provide each student with useful feedback and appropriate next steps.

We have learned from Piaget, Vygotzky, and their disciples that effective learning is not the product of instruction, in which the teacher pours knowledge into passive brains, but of construction by active, individual brains that create meaning.

However, educational systems around the world have been unable to move from instruction to construction, even though they may accept the need to do so, because they have lacked the necessary tools and applications.

Technology appeared to offer a solution. The "learning machines" of the 1950s and 1960s displayed multiple-choice questions and provided positive or negative reinforcement with a focus on behaviorism, the dominant school of psychology at the time.

Cognitive psychology, which replaced behaviorism, brought in tutorial systems during the 1970s and 1980s in which computer programs performed like private tutors, providing information, asking questions, and offering feedback and direction. Tutorials were circulated on CDs or as part of an integrated learning system (ILS).

Both approaches assumed that computers could function as teachers and that human teachers would become marginal. However, the complexity of the thinking and learning process, the need for human contact, and a more positive view of the role of teachers eventually removed both options from the educational agenda.

The availability of desktop computers and the Internet restored technology to education, generally in the form of a computer center or lab and an Internet connection in every school. Teachers were expected to have the time available to develop content, and the computers and teacher-developed content were expected to do the job. As a result, computers were hardly ever included in teaching and learning, and there were calls for the educational system to forget about computers altogether.

A New Harmony

Today a new approach is emerging. Pedagogy and technology are coming together in a new way that seamlessly connects computers and digital content. Digital content is returning to center stage as an interactive tool that lets the teacher motivate learning in the classroom and works in harmony with smart teachers and smart technology to create smart classrooms unlike any that existed in the past.

Time To Know is bringing together the five elements needed to orchestrate pedagogy and technology effectively so that they can truly impact student learning:

- **Technological infrastructure**
    - A personal computer for every teacher and student
    - A school-wide communications infrastructure
- **Interactive core curriculum**
    - Promotes significant learning
    - Develops understanding and thinking
    - Adapts to the abilities and needs of learners
    - Provides a continuous plan of studies
    - Can be easily augmented and adapted by the teacher
- **Digital Teaching Platform**
    - Planning and administration of teaching, learning, and evaluation
    - Lesson creation and management
    - Performance tracking
    - Reporting and feedback
    - Collaboration tools for teachers and students
- **Professional learning for teachers**
    - Thirty hours of training for every teacher
    - Weekly guidance for the first year from instructors with experience in the same field
- **Technical support**
    - Available throughout the school day

These elements come together to help teachers build a strong teaching, learning, and evaluation structure without having to develop huge amounts of material or combine disconnected material and technology tools.

The teacher and the technology environment work together in harmony in the classroom. The computer performs certain tasks. It demonstrates the material, activates the student, gathers information, and communicates back and forth. The teacher performs other tasks. He or she guides instruction, makes decisions based on evaluation reports, and works with individual students and small groups.

Synergies and Symphonies

The pedagogical principle underlying Time to Know is that significant learning takes place as a result of the synergy among three elements within the computerized environment:

- **Active learning in which knowledge is constructed and applied with the guidance of the teacher.** Time to Know activates students, fosters curiosity and inquisitiveness, demonstrates abstract concepts, and guides students in activities that promote understanding and practice.
- **Collaborative learning.** Time To Know enables decentralized learning and thinking for teachers and students, transfers knowledge for presentation purposes, and turns knowledge into an object of joint study and inquiry.
- **Differentiated learning.** Time To Know adapts to students' pace of learning, supports them with feedback, responds to their choices, and allows them follow their interests according to their preferred style.

Time To Know is not a computer lab where students sit with headphones on for two hours a week and go through a tutorial or game. It is much more than just an interactive whiteboard that lets the teacher present information in an attractive way but leaves the students passive. It is a new experience of learning.

The systemic solution described here is only one stage in the development of the technology-pedagogy symphony. The Time To Know team is working on advanced capabilities that include a collaborative interdisciplinary research environment, a three-dimensional game environment for practice purposes, and more.

The computer is not a substitute for the teacher but a supplement that adds new power and quality. This formula—a human being + a computer = higher quality—has already been applied successfully in other workplaces. The time has come to apply it to schools also.

Time To Know provides teachers with pedagogical tools for orchestrating a classroom of learners and conducting pedagogical symphonies—to the enjoyment and benefit of conductors, musicians, and audience alike.