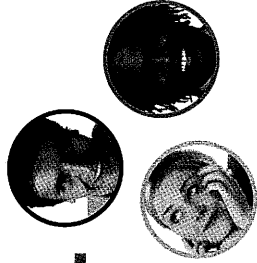


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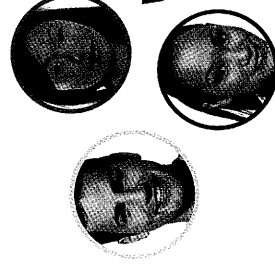
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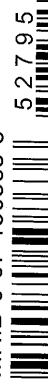
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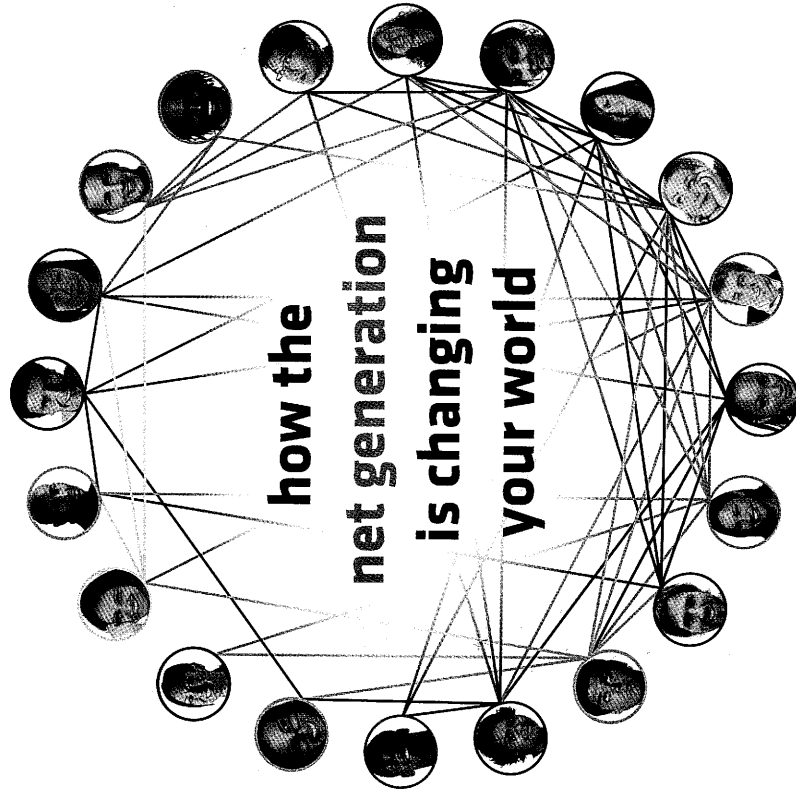
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tem do what some of the leading customer-faced companies are doing today? Focus on the customer, or in this case, the student. It sounds simple, but, as many companies have found, focusing on the customer requires a deep change throughout the organization. This means changing the relationship between student and teacher in the learning process. To focus on the student, educators must abandon the old system in which the teacher delivers the lecture, the same lecture to all students. First, teachers have to step off the stage and start listening and conversing instead of just lecturing. In other words, they have to abandon their broadcast style and adopt an interactive one. Second, they should encourage students to discover for themselves, and learn a process of discovery and critical thinking instead of just memorizing the teacher's information. Third, they need to encourage students to collaborate among themselves and with others outside the school. Finally, they need to tailor the style of education to their students' individual learning styles.

Some leading educators are calling for this kind of massive change; one of these is Richard Sweeney, university librarian at the New Jersey Institute of Technology. He says the education model has to change to suit this generation of students. Smart but impatient, they like to collaborate and they reject one-way lectures, he notes. While some educators view this as pandering to a generation, Sweeney is firm: "They want to learn, but they want to learn only what they have to learn, and they want to learn it in a style that is best for them."²³

FROM BROADCAST TO INTERACTIVE LEARNING

The old system is what I call one-size-fits-all, one-way broadcast learning. It was designed for the Industrial Age, when industry needed workers who did what they were told. The teacher was the sage, and he or she was supposed to deliver knowledge to the grateful students, who were expected to write down the sage's words and deliver it back to them, often word for word, in exams if they wanted to score an A. Unusual questions were not appreciated. When I was in the second grade, for instance, I asked, "Why is there snow at the top of the mountain when it's actually closer to the sun?" The annoyed teacher told my mother that I probably wouldn't graduate from high school, and I certainly wouldn't amount to much.

In the old model, the teacher is the broadcaster. A broadcast is by definition the transmission of information from transmitter to receiver in a one-way, linear fashion. The teacher is the transmitter and student is a receptor in the learning process. The formula goes like this: I'm a teacher (or professor) and I have knowledge. You're a student and you don't. Get ready, here it comes. Your goal is to take this data into your short-term memory and through practice and repe-

tion build deeper cognitive structures so you can recall it to me when I test you. As I often tell educational audiences, the definition of a lecture is the process in which the notes of the teacher go to the notes of the student without going through the brains of either. As someone who gives many lectures a year, I appreciate the irony of this view.²⁴

So is it any surprise that teacher-broadcasters and TV broadcasters are both losing their audience? Kids who have grown up digital are abandoning one-way TV for the higher stimulus of interactive communication they find on the Internet. Sitting mutely in front of a TV set—or a teacher—doesn't appeal to this generation. But unlike the entertainment world, the educational establishment doesn't offer enough alternatives to the one-way broadcast.

There are shining examples of interactive education, though. Dr. Maria Terrell teaches calculus at Cornell University, and she definitely does not stand at the front of the class and draw on the blackboard. In the classroom with 22 students, she walks up and down the rows of desks as the class is finishing "warm-up questions" that have been assigned before class. "Talk about your answer with your neighbors," she tells the students. "Justify your answer with a theorem. No looking in your textbook."

She works the aisles like a dynamic game-show host, jumping in occasionally to help out. When one student says he has no idea how to answer the question, Dr. Terrell interjects, "Well, you do have some idea from your knowledge. Draw a picture . . ." Later, she takes the spotlight at the front of the class, jotting down the student's thoughts about how to solve the problem. "Any more ideas?" No one has any. "Keenan, your stuff looks so good there," she says, eyeballing one of the students. "Do you want to put it on the board?" "No," says Keenan. "Awww, come on . . ." Terrell says in her most persuasive game-show tone. The student, egged on by the entire class, reluctantly approaches the board, and draws the theorem and explains his answer.

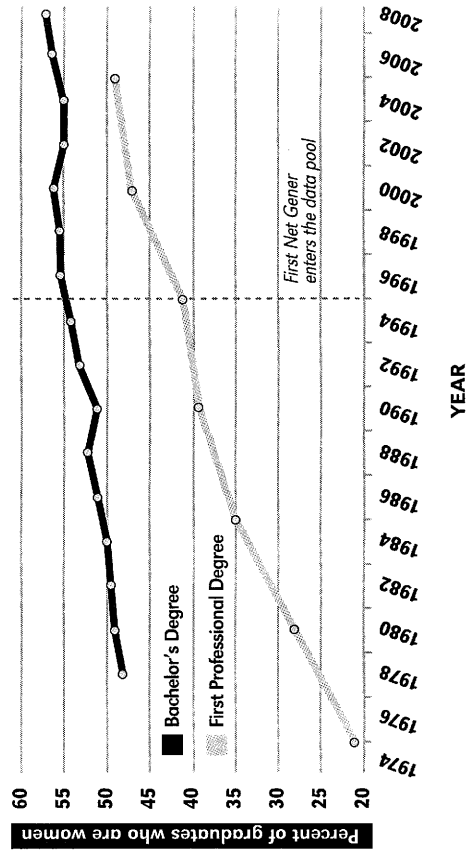
—KEENAN BORDE, 19, ITHACA, NEW YORK

At Cornell, this interactive method has been integrated into the introductory calculus courses through a National Science Foundation grant-funded program called "Good Questions."²⁵ One strategy being used in this program is called just-in-time teaching: it is a teaching and learning strategy that combines the benefits of Web-based assignments and an active-learner classroom where courses are customized to the particular needs of the class. Warm-up questions, written by the students, are typically due a few hours before class,

giving the teacher an opportunity to adjust the lesson “just in time,” so that classroom time can be focused on the parts of the assignments that students struggled with. Harvard professor Eric Mazur, who uses this approach in his physics class, puts it this way: “Education is so much more than the mere transfer of information. The information has to be assimilated. Students have to connect the information to what they already know, develop mental models, learn how to apply the new knowledge, and how to adapt this knowledge to new and unfamiliar situations.”²⁶

This technique produces real results. A study of 350 Cornell students evaluated the impact of a key part of the Good Questions program, called “deep questions,” which elicit higher order thinking. Students who were asked “deep questions” and participated in frequent peer discussion scored noticeably higher on their math exams than students who were not asked deep questions or who had little to no chance for peer discussion. Dr. Terrell explains: “It’s when the students talk about what they think is going on and why, that’s where the biggest learning occurs for them. . . . You can hear people sort of saying, ‘Oh I see, I get it.’ . . . And then they’re explaining it to somebody else. . . . and there’s an authentic understanding of what’s going on. So much better than what would happen if I, as the teacher person, explain it. There’s something that happens with this peer instruction.”

FIGURE 5.3 MORE WOMEN ARE GRADUATING FROM COLLEGE



Source: National Center for Educational Statistics
 *First professional degree includes the fields of dentistry (D.D.S. or D.M.D.), medicine (M.D.), osteopathy (O.D.), osteopathic medicine (D.O.), pharmacy (D. Pharm.), podiatric medicine (D.P.M.), veterinary medicine (D.V.M.), chiropractic medicine (D.C. or D.C.M.), law (J.D.), and the theological professions (M. Div. or M.H.L.).

Interactive education enables students to learn at their own pace. I saw this myself back in the mid-1970s when I was taking a statistics course for my graduate degree in educational psychology at the University of Alberta. It was one of the first classes conducted online—an educational groundbreaker from Dr. Steve Hunka, a visionary in computer-mediated education. This was before PCs, so we sat down in front of a computer terminal that was connected to a computer-controlled slide display. I could stop at any time and review, and test myself to see how I was doing. The exam was online too. There were no lectures. Just as well: the statistics lecture is by definition a bust. Instead, we got face-to-face time with Dr. Hunka, who was freed up from lecturing to spend time with us one-on-one.

Back then, online learning was expensive, but today the tools on the Net make it a great way to teach kids and free up the teacher to design the learning experience and converse with the students on an individual and more meaningful basis. It works. The research evidence is very strong and growing. As one extensive report described over a decade ago:

“Compared with students enrolled in conventionally taught courses, students who use well-crafted computer-mediated instruction . . . generally achieve higher scores on summary examinations, learn their lessons in less time, like their classes more, and develop more positive attitudes towards the subject matter they’re learning. These results hold for a broad range of students stretching from elementary to college students, studying across a broad range of disciplines, from mathematics to the social sciences to the humanities.”²⁸

FIGURE 5.4 BROADCAST LEARNING VERSUS INTERACTIVE LEARNING

