

# Never Send a Human to Do a Machine's Job

*Correcting the Top 5 EdTech Mistakes*

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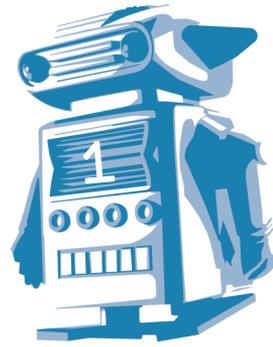
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# Contents

<b>About the Authors</b>	<b>v</b>
<b>Introduction</b>	<b>1</b>
<b>1. The Wrong Relationship Between Technology and Teachers: Complementing in an Ecosystem Versus Replacing in a Hierarchy</b>	<b>9</b>
An Ecosystem, Not a Hierarchy: Reconsidering the Relationship Between Teachers and Technology	11
Technology and Teachers in a Learning Ecosystem: What Are Their Niches?	16
Constructing a Learning Ecosystem: What Does It Look Like?	26
<b>2. The Wrong Application: Technology as Tools for Consumption Versus Tools for Creating and Producing</b>	<b>33</b>
The First Approach: Technology as a Tool for Consumption	34
Constructivism: Constructing by Creating and Producing	37
Wikipedia: A Mass Project of Creating and Making	40
Digital Stories, Twitters, Blogs, Videos, and Robots: New Genres of Creating and Making	43
Diverse Needs as Creators and Makers	46

<b>3. The Wrong Expectation: Technology to Raise Test Scores Versus Technology to Provide Better Education</b>	<b>55</b>
Can Technology Boost Test Scores?	
Don't Let the Wrong Question Guide Our Technology Use	56
Providing Better Education: The Real Value of Educational Technology	60
<b>4. The Wrong Assumptions: Technology as Curriculum Versus Digital Competence</b>	<b>73</b>
The Wrong Assumptions: Technology as Curriculum/Instruction	75
What Is Digital Citizenship?	77
Developing Digital Citizenship Through the Use of Digital Technology	86
<b>5. The Wrong Technology Implementation: Top Down Versus Bottom Up</b>	<b>93</b>
Two Technology Paradoxes	93
Before 3 p.m. Model	94
After 3 p.m. Model	95
Before 3 p.m. Versus After 3 p.m.: What Are the Differences?	97
Alternative Ways to Implement Technology	101
Conclusion	106
<b>6. Making It Right: Reimagining Education in the Second Machine Age</b>	<b>109</b>
The Need for Reimagining Education	112
Reimagining the What: Curriculum	113
Reimagining the How: Pedagogy	118
Reimagining the Teacher-Machine Relationship: Summary	123

## CHAPTER ONE



# The Wrong Relationship Between Technology and Teachers

*Complementing in an Ecosystem Versus Replacing in a Hierarchy*

*Will classroom TV replace teachers?*

James Montagnes raised this question in his article that appeared in the *Eugene Register-Guard* on December 16, 1954. The question was very timely since the 1950s was a time of unprecedented development of television. The percentage of American homes that had television sets jumped dramatically from 5% in 1950 to 87% in the end of the 1950s (Sterling & Kittross, 1990). In his article, Montagnes reported a large-scale experiment in Canada in which fifth, sixth, seventh, and eighth graders in 200 schools watched TV programs on

current events, history, art, science, safety, and literature. An example of a televised lesson was “How Columbus Navigated.” This 20-minute film showed the actual types of instruments Columbus used for his trip and how he demonstrated to the crew that he knew he wasn't lost. Montagnes's article concluded with the prediction that “the day will come when video is as commonplace in schools as erasers and blackboards.” At the end of the article, Montagnes asked a perplexing question: “Will TV receivers in classrooms change the role of the teacher and someday largely replace her?”

Since then James Montagnes's question of about whether teachers will be replaced has been revisited from time to time. Every time when there is a major technology innovation that holds great potential in teaching and learning, this question is raised again. The prevalence of computers in schools brought probably the most heated debate on the topic. In the 1990s President Bill Clinton campaigned for “a bridge to the twenty-first century . . . where computers are as much a part of the classroom as blackboards” (quoted in Oppenheimer, 1997). And two decades later, that became the reality. By 2009, approximately 97% of teachers in the United States had at least one computer in the classroom every day and 54% could bring computers into the classroom (Gray, Thomas, Lewis, & Tice, 2010). Internet access also became widely accessible, available for 93% of computers located in the classroom every day and for 96% of computers that could be brought into the classroom. Also by 2009, the ratio of students to computers in the classroom every day was 5.3 to 1 (Gray et al., 2010). As a result, variations on Montagnes's question made more headlines: “Quality Debated as Districts Tap Tech Over Teachers” from *Education Week* (Quillen, 2012), “Can Computers Replace Teachers?” from *TIME Ideas* (Rotherham, 2012), and “Can Computers Take the Place of teachers?” from *CNN Opinion* (Mitra, 2010).

Very soon, online education became the next target of the question as it was the fastest-growing segment of education (Allen & Seaman, 2011). According to a recent report on online education in the United States, over 6.1 million students took at least one online course during the fall 2010 term, an increase of 560,000 students over the previous year (Allen & Seaman, 2011). In addition, the 10% growth rate for online enrollments far exceeds the average 2% growth in the overall higher education student population. The most recent version of the question is “Can tablets replace teachers?” (“Digital Schools,” 2013).

So here are different generations of James Montagnes's question, and new versions will likely arise when we experience new technology innovations.

Will TV replace teachers?

Will computers replace teachers?

Will online education replace teachers?

Will tablets replace teachers?

While these questions focus on a particular technology that became prevalent in classrooms and seemed promising for teaching and learning, the essence of such questions remains the same: What is the relationship between technology (e.g., TV, computers, the Internet, tablets) and teachers? Does (or can) technology fully assume teachers' responsibilities, as various versions of the question "Will teachers be replaced?" suggest?

## **AN ECOSYSTEM, NOT A HIERARCHY: RECONSIDERING THE RELATIONSHIP BETWEEN TEACHERS AND TECHNOLOGY**

### **A Hierarchy: Displacement Theory and Media Comparison Studies**

These questions illustrate well the displacement theory and media comparison studies, both of which view the relationship between media (i.e., all kinds of technology and teachers) as a hierarchy. The hierarchy mindset is committed to finding out which medium is the best.

The primary interests of the displacement theory are "Is B better than A?" and "Can B replace A?" Here B represents a new medium (e.g., radio, television, computers, the Internet) while A is the existing medium. When a new medium is acquired, people who embrace the displacement theory would label the new medium as a threat to the existing medium. They are eager to find out which one is better. Research that is guided by the displacement theory tends to conduct head-to-head comparison between a new type of educational technology and the existing medium, such as between radio and newspaper

(Lazarsfeld, 1940; Mendelsohn, 1964), between television and newspapers/magazines/radio (Belson, 1961; E. Rubenstein et al., 1973; Williams, 1986), and recently between computers and the Internet (Althaus & Tewksbury, 2000; Finholt & Sproull, 1990; Kayany & Yelsma, 2000; Kaye & Johnson, 2003).

By the same token, the pressing questions of media comparison studies are “Is B (e.g., a new educational technology) better than teachers?” and “Can B (e.g., a new educational technology) replace teachers?” These two questions serve as the template for different versions of James Montagnes’s question. A large body of research has been conducted in an attempt to answer these two questions (see meta-analyses by Cohen, Ebling, & Kulik, 1981; C. Kulik, Kulik, & Cohen, 1980; J. Kulik, Bangert, & Williams, 1983; J. Kulik, Kulik, & Cohen, 1979). A typical study would compare the achievement of participants who learn from different media. A recent example is a study by the U.S. Department of Education on the effectiveness of reading and mathematics software products (National Center for Education Evaluation and Regional Assistance, 2007). The study compared student achievement in four groups between the classrooms that used the technology products and traditional classrooms that did not. The four groups were reading in first and fourth grades, mathematics in sixth grade, and high school algebra (National Center for Education Evaluation and Regional Assistance, 2007).

Both displacement theory and media comparison studies are driven by an assumption that media are a hierarchy and that we have to rank media to find out which is better in instruction. However, consistent and strong evidence has found that there are no learning benefits from just employing a specific medium to deliver instruction, from the radio research in the 1950s (e.g., Hovland, Lumsdaine, & Sheffield, 1949), to the television movement of the 1960s (e.g., Schramm, Lyle, & Parker, 1961), to the computer-assisted instruction studies in the 1970s and 1980s (e.g., Dixon & Judd, 1977). In his comprehensive review of media comparison studies, Richard E. Clark (1983) concludes, “Five decades of research suggest that there are no learning benefits to be gained from employing different media in instruction, regardless of their obviously attractive features or advertised superiority” (p. 450). Repeated comparison of face-to-face education and Web-based instruction seems to lead to the same conclusion. Recent results from Bernard et al. (2004) and other reviews of the distance education literature (Cavanaugh, 2001; Moore, 1994)

indicate no significant differences in effectiveness between distance education and face-to-face education.

## An Ecosystem: Dancing With Robots and a Transmedia Learning System

As learning differences cannot be unambiguously attributed to any medium of instruction (e.g., radio, TV, computers), we should be advised against a hierarchy paradigm. Instead, we should understand that an effective learning environment consists of a variety of media, as an ecosystem includes all of the living things (e.g., plants, animals, other organisms). This chapter argues that we need to change our perspectives on learning media. These media are not a hierarchy; they are an ecosystem.<sup>1</sup> In an ecosystem, each organism has its own niche and its own role to play. In the same vein, in an optimal learning environment, each learning medium, teachers in particular, should find and occupy its own niche (e.g., the unique functions that this medium has; functions that other media either don't have or cannot perform as well as this particular medium) and complement each other's role in the system.

To view a learning environment as an ecosystem, we have to shift our focus from finding the better (and even the best) learning medium to understanding the niche and the strength of each medium and taking into consideration the interrelationships among these media. To be more precise, we need to first analyze the strengths/niches of computers and humans and then construct a learning environment that taps the strengths/niches of both. This process is illustrated in both *Dancing With Robots* (Levy & Murnane, 2013) and *A Transmedia Learning System for Language Learning* (Zhao, 2011). Levy and Murnane (2013) argue that humans should be “dancing with robots.” The main idea is to let computers (i.e., robots) do what they are good at, and humans should be trained to do what computers don't do. Levy and Murnane do a nice job of reviewing “how computers do what they do” and “what computers don't do (yet)” (pp. 6, 9). According to them, computers can substitute for humans when computers have all the needed information to complete the task and such information is reorganized and

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1. The sentence is inspired by Leonard Cassuto's (2013) article “We're Not a Hierarchy, We're an Ecosystem: Graduate Programs Should Ignore the Ranking and Find Their Niche.”

acquired in a form that computers can process. For example, the self-service airport kiosks process information in a “logical, step-by-step procedure”:

Does the name on the credit card match a name in the reservation data base?

If Yes, check for a seat assignment.

If No, instruct customer to see desk agent. (Levy & Murnane, 2013, p. 7)

However, computers cannot perform tasks when they have to solve new problems (i.e., problems that even the “rules writers” did not anticipate) or problems that cannot be processed by prescribed “logical, step-by-step procedures.” And that’s when human input of cognitive complexity is required. The self-check-in kiosk has to refer customers to a desk agent since the prewritten program doesn’t provide alternative reactions when the name on the credit card doesn’t match a name in the reservation database. Human work in this example requires skills to communicate (which cannot be programmed since it has to respond to unpredicted responses) and to solve problems in new conditions.

To simultaneously incorporate the strengths of technology and humans and address their limitations, Levy and Murnane (2013) propose a framework of “dancing with the robots.” The focus of the framework is to let computers solve routine problems and to direct human work to “solving unstructured problems, working with new information, and carrying out non-routine manual tasks” (p. 3)—three types of tasks that computers cannot successfully perform. In other words, they believe we should use computer competency to complement human skills.

If the current iteration of James Montagnes’s question were presented to Levy and Murnane, their answer would be no, teachers cannot be replaced by computers. Instead, they argue that teaching is a profession that requires non-computer skills, such as solving unstructured programs and working with new information. Therefore, teachers won’t be simply replaced. “Teaching, selling, managing, reporting—these and many other jobs emphasize communication because their task is to exchange not just information but a particular understanding of information” (Levy & Murnane, 2013, p. 18).