

Is Technology Producing a Decline in Critical Thinking and Analysis?

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As technology has played a bigger role in our lives, our skills in critical thinking and analysis have declined, while our visual skills have improved, according to research by Patricia Greenfield, UCLA distinguished professor of psychology and director of the Children's Digital Media Center, Los Angeles.

Learners have changed as a result of their exposure to technology, says Greenfield, who analyzed more than 50 studies on learning and technology, including research on multi-tasking and the use of computers, the Internet and video games. Her research was published this month in the journal *Science*.

Reading for pleasure, which has declined among young people in recent decades, enhances thinking and engages the imagination in a way that visual media such as video games and television do not, Greenfield said.

How much should schools use new media, versus older techniques such as reading and classroom discussion?

"No one medium is good for everything," Greenfield said. "If we want to develop a variety of skills, we need a balanced media diet. Each medium has costs and benefits in terms of what skills each develops."

Schools should make more effort to test students using visual media, she said, by asking them to prepare PowerPoint presentations, for example.

"As students spend more time with visual media and less time with print, evaluation methods that include visual media will give a better picture of what they actually know," said Greenfield, who has been using films in her classes since the 1970s.

"By using more visual media, students will process information better," she said. "However, most visual media are real-time media that do not allow time for reflection, analysis or imagination — those do not get developed by real-time media such as television or video games. Technology is not a panacea in education, because of the skills that are being lost.

"Studies show that reading develops imagination, induction, reflection and critical thinking, as well as vocabulary," Greenfield said. "Reading for pleasure is the key to developing these skills. Students today have more visual literacy and less print literacy. Many students do not read for pleasure and have not for decades."

Parents should encourage their children to read and should read to their young children, she said.

Among the studies Greenfield analyzed was a classroom study showing that students who were given access to the Internet during class and were encouraged to use it during lectures did not process what the speaker said as well as students who did not have Internet access. When students were tested after class lectures, those who did not have Internet access performed better than those who did.

"Wiring classrooms for Internet access does not enhance learning," Greenfield said.

Another study Greenfield analyzed found that college students who watched "CNN Headline News" with just the news anchor on screen and without the "news crawl" across the bottom of the screen remembered significantly more facts from the televised broadcast than those who watched it with the distraction of the crawling text and with additional stock market and weather information on the screen.

These and other studies show that multi-tasking "prevents people from getting a deeper understanding of information," Greenfield said.

Yet, for certain tasks, divided attention is important, she added.

"If you're a pilot, you need to be able to monitor multiple instruments at the same time. If you're a cab driver, you need to pay attention to multiple events at the same time. If you're in the military, you need to multi-task too," she said. "On the other hand, if you're trying to solve a complex problem, you need sustained concentration. If you are doing a task that requires deep and sustained thought, multi-tasking is detrimental."

Do video games strengthen skill in multi-tasking?

New Zealand researcher Paul Kearney measured multi-tasking and found that people who played a realistic video game before engaging in a military computer simulation showed a significant improvement in their ability to multi-task, compared with people in a control group who did not play the video game. In the simulation, the player operates a weapons console, locates targets and reacts quickly to events.

Greenfield wonders, however, whether the tasks in the simulation could have been performed better if done alone.

More than 85 percent of video games contain violence, one study found, and multiple studies of violent media games have shown that they can produce many negative effects, including aggressive behavior and desensitization to real-life violence, Greenfield said in summarizing the findings.

In another study, video game skills were a better predictor of surgeons' success in performing laparoscopic surgery than actual laparoscopic surgery experience. In laparoscopic surgery, a surgeon makes a small incision in a patient and inserts a viewing tube with a small camera. The surgeon examines internal organs on a video monitor connected to the tube and can use the viewing tube to guide the surgery.

"Video game skill predicted laparoscopic surgery skills," Greenfield said. "The best video game players made 47 percent fewer errors and performed 39 percent faster in laparoscopic tasks than the worst video game players."

Visual intelligence has been rising globally for 50 years, Greenfield said. In 1942, people's visual performance, as measured by a visual intelligence test known as Raven's Progressive Matrices, went steadily down with age and declined substantially from age 25 to 65. By 1992, there was a much less significant age-related disparity in visual intelligence, Greenfield said.

"In a 1992 study, visual IQ stayed almost flat from age 25 to 65," she said.

Greenfield believes much of this change is related to our increased use of technology, as well as other factors, including increased levels of formal education, improved nutrition, smaller families and increased societal complexity.

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