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Technology and the Brain: Learning to Use One, Developing and Expanding the Other

A Position Statement and Call to Action

“Children must be taught how to think, not what to think.”

Margaret Mead

A recent report from the National Education Association (March 11, 2016, NEA Morning Update) referred to data from the 2012 Program for International Assessment of Adult Competencies. This study found that United States students are average or well behind other countries in literacy, numeracy, and digital problem-solving, and that US adults lag well behind those in other countries in the skills needed to succeed in the work force, especially in complex problem-solving skills. With the tremendous prevalence of and reliance on technology in our society, US millennials are proficient with the basics, but are behind in their ability to solve high-level problems with technology.

Technology is now a fact of life, and a tremendous resource in accessing information, streamlining processes and procedures, and expanding communication systems. However, it does not replace the human brain, and the far greater abilities of the brain must be developed in order for us to use and take technology to its full potential. Technology is an advanced tool for the brain, not the brain itself. It is not the tools that do the job for the carpenter, it is the skilled carpenter who knows how to make optimal use of his or her tools in doing the job.

My husband asked me how I think reliance on technology is affecting children's cognitive development and learning abilities. I responded that when relying on technology for learning and entertainment children do not learn how to figure things out for themselves or solve new problems. When they go to the internet, plug in a keyword or question designated in their assignment, are given the information or answer they need, and then write it down and turn it in, they do not develop and use their own reasoning skills. They do not pull from their own knowledge, observations, and experiences, and from the vast resources in their environment, integrating all of this information to advance in understanding, generate new questions and ideas, test hypotheses, and solve problems on their own.

They also learn to expect the information they need to be handed to them in bullet points without having to search their environment, read through text, consult and collaborate with others, or discriminate the important from the extraneous in reading, observing, researching, forming concepts, and learning. They don't learn to enjoy reading books,

expanding their minds with the rich, narrative presentations of fantasy, ideas, events, people, experiences, and worlds they could not access otherwise. When their life and their play focuses on images presented on a screen they do not develop their imaginations, vastly limiting the richness of their thought and language as well as their ability to grow in creativity, curiosity, and socialization. As Albert Einstein said, "Play is the highest form of research."

My husband then asked me where I read these things. I did not - I creatively formed these concepts and this understanding based on an integration of my many years of education, research, training, observations, and experience in education, brain development, and children's cognition, language, play, behavior, and learning, something a computer can't do and a skill I developed by learning to figure things out for myself as I was growing up.

The human brain, as a miraculous, incredibly complex, intricately interwoven system of executive, cognitive, social, sensory, and emotional processes, among others, is capable not only of acquiring and applying knowledge, but also of pulling information and ideas from a constantly changing, advancing, and expanding array of resources, forming connections among existing information and ideas, applying observations and experiences in novel ways, generating new ideas, and testing hypotheses to solve new problems. The brain can incorporate knowledge, experience, forethought, and emotion into decision-making, all of which are essential in the process. The brain is capable of emotion, socialization, creativity, critical thinking, and novel problem-solving, processes that are critical for progress and success at all levels of society but can't be wired into a computer.

Computers function solely based on crystallized intelligence, or existing knowledge (what was programmed), while the human brain uses both crystallized intelligence and fluid intelligence, or the ability to generate new ideas and solve novel problems. Our brains also incorporate emotional intelligence. All of this allow us to create instead of just replete. The brain is also capable of effectively working in collaboration with others, combining the expertise, knowledge, and experiences of diverse individuals to accomplish much more than any one person or computer can.

When education and play rely excessively on technology, or even "old school" didactic instruction, and do not develop the full range of brain skills, we are stunting the development and abilities of our children. This vastly limits their ability to succeed in life, and in the long run bars advances in our society and world. We need to teach students how to effectively use technology at advanced levels as an information resource, method of communication from interpersonal to worldwide, and means of organization and efficiency. We also need to foster the development of their brain skills and expand their awareness, creativity, thinking, reasoning, problem-solving, and socialization so that their worlds can reach far beyond the screen, and so that they can gain the brain skills needed to make optimal use of and generate creative advances in technology, the sciences, and engineering.

This starts early in children's education by fostering social, creative/constructive, pretend, and dramatic play; providing experiences in exploratory art and music; creatively exploring concepts and helping them discover different way to apply them in the classroom and in their lives (e.g., number, size, and quantity concepts; classifications and other abstract verbal concepts); and finding how many different places and ways new knowledge appears in their environment and lives. Younger children also need to start learning how to identify problems, brainstorm ideas, and evaluate the pros and cons of each in attempting to solve problems.

Effective education then continues with class discussions about lessons and stories read to them or they read. Such discussion include encouraging the students to think about and share with each other and the class how the information, ideas, characters, and events relate to their experiences and can be seen and applied in the world around them. It involves having the students create and illustrate their own stories in which they are characters in the setting, event, or culture about which they are learning instead of just teaching them the facts, as well as other activities in applying knowledge and self-expression in creative writing and art. It involves opening the students' worlds beyond core academics and technology to the amazing personal and cultural experiences found in literature and in the fine and performing arts that make life rich and meaningful and establish paths connecting us with the farthest reaches of world cultures and history.

Developing the true understanding and reasoning abilities needed to use our tools to their full potential and continue to progress includes teaching about and exploring the concepts upon which procedures are based throughout students' education. Building on such concepts, students then progress into creating and discovering new ways to apply the concepts and standard procedures and new ways to solve standard problems. Children need to be encouraged and learn to question what is known, to look for answers to the unknown, instead of just receiving information.

Effective teaching means putting the computer or iPad away and having the students explore ideas and figure problems out for themselves based on what they already know and what they can access in their environment, generating ideas and testing hypotheses, individually and in groups. It includes forming teams of diverse students and teaching them to work together in making plans, applying knowledge, carrying out procedures, and solving problems in activities within the classroom, around the school, and in the community. It also means teaching and modeling problem-solving procedures in multiple situations and contexts, and being as much or more a facilitator as a teacher in helping the students explore what is known and then generate, evaluate, and apply ideas that are meaningful to them and their lives as they develop new knowledge and skills and find ways to implement them.

The elementary and secondary school educations of Charles Flint, the founder of what became IBM, of Paul Allen and Bill Gates, the founders of Microsoft Corporation, and of Steven Jobs and two others, the founders and inspiration of Apple, were not focused on technology. They were focused on learning to think, to read (including a strong dose of classic literature), to create, explore, and analyze ideas, to write creatively, persuasively,

and analytically, to figure things out, to solve problems, and to understand the history and systems of the society and world we live in. They were then able to envision and generate tremendous strides in the development and improvement of technology as a tool for progress.

When children learn, starting at an early age, to use their brains the way they were meant to be used – to socialize, explore, question, discover, solve problems, expand their worlds, and grow – they learn to love learning, they reach their full potential, they learn to actively seek progress, they understand how tools such as technology can be used to their full advantage and grow in their use, and they become the workforce that puts this nation back at the top.

They are also a lot happier, happy children learn better and grow healthier, and this world becomes a better place for everyone.

P.S. Sometime after writing this, I found substantial qualitative and quantitative agreement, validation, and research support for many of these developmental concepts, along with a lot of other good insights, ideas, and suggestions, contained in the peer-reviewed research article, *Remote Control Childhood: Combating the Hazards of Media Culture in Schools*, by Diane Levin of the Wheelock College in Boston (*New Horizons in Education*, Vol. 58, No. 3., December 2010, available online for free download in ERIC – eric.ed.gov).