

1 A Brief Essay on Digital Transformation and Supplemental Instruction (SI)

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Abstract: Since the advent of the fourth industrial revolution, the digitalization and transformation of communication, work, and play have been taking place at an increasingly rapid pace. These changes have also been influencing students. It is changing and has changed their approach to learning, and the technologies are affecting their brain structure in ways that the consequences of which are yet to be determined. Meanwhile, the presence of digital gadgets and apps contribute to an increasing loss of focus and attention in the classroom. Also, the easy access to information through the ubiquitous search engine is reducing students' long-term memory capabilities. In this brief essay, some of these issues are discussed, and it is proposed the use of SI is a small step in solving some of these problems.

Introduction

Birds do it, bees do it, even uneducated ants do it. In the animal kingdom, there are many examples of how insects and animals construct complicated structures, navigate long distances, or organize into cohesive communities without apparently any instruction from their elders or peers. They enjoy these abilities simply because they are born with a specific genetic memory, a memory that is present at birth. Bee workers instinctively know how to build a beehive, go about housekeeping, feed the queen, drones and larvae, collect pollen and nectar, and make wax. Humans, on the other hand, are different.

Humans are born with a work-in-progress brain (Shonkoff & Phillips, 2000), which, to a large extent, is a 'tabula rasa' or a clean slate. Although by age two, the human brain has developed to about 75% of its adult size (Huelke, 1998). The rational part of the brain takes approximately 25 years to fully develop ("Understanding the Teen Brain," n.d.). From infancy to adulthood, humans have to protect and teach their offspring about their environment so they can first survive and later become a functioning member of society. The learning process is done in both formal (schools) and informal settings. This chapter is concerned with is the learning process in the formal educational setting.

Education is defined as 'the act or process of imparting or acquiring particular knowledge or skills, as for a profession' (*The Definition of Education*, n.d.). Education is supposed to develop critical thinking, analysis, exploration and be a gateway to immense opportunities. Confucius (551–479 BCE) saw the purpose of education as more closely tied to social development than to individual development, emphasizing respect for one's elders, self-discipline, and correct behavior. He, like Plato, believed that educated people should govern the state. "Those who excel in office should learn:

those who excel in learning should take office” (Huang, 1997, p. 180). Later, Plato voiced similar ideas.

For Plato (427–347 BCE), the essential thing was morality. In his book *Republic* (Sayers, 380 BCE/1999 CE), he lays out a program for educating the leaders (philosopher-kings) of the utopian political system. He argued that leaders should study mathematics for ten years before starting their philosophical education. This is because abstract, disciplined thinking is essential to philosophical inquiry. This, of course, was wishful thinking, and Plato knew that this would never be accepted by the public.

Other philosophers also had problems with school. Saint Augustine of Hippo (354–430) hated his school because of the beatings that he had received there (Augustine & Pusey, 2013). Desiderius Erasmus (1466–1536) received his education from the clergy in monastic schools and from John Stuart Mill (1806–1873), one of the earliest proponents of compulsory universal education (Mill, 2015). And John Dewey (1859–1952), who “severely criticized public schools for silencing and ignoring student interests and experiences” (Cooper et al., 2002, p. 180); they all found their educational system lacking or wrong for their time. Each saw the shortcomings of their time’s educational system and voiced concerns and, at times, even outrage at the ineffectual and sometimes harmful educational system (Strømmen-Bakhtiar, 2020). The same problems that previous thinkers, philosophers, and teachers faced are also being faced today. The present educational system may be suffering from the very technology that promises untold opportunities and riches. The educational system that was based on mass production is now being increasingly thought of as old fashioned and not fit for the purpose.

New technology and economic ideologies and policies emphasize the individual self-interest as the driving force in society. Consequently, developers are trying to take advantage of this phenomenon by developing applications and technologies that advance and facilitate this ideology. All the likes and selfies are an indication of this self-adoration and self-interest. But, there is also money to be made. Youtube, Instagram, and other platforms allow the people to enjoy temporary popularity and bask in the admiration of their followers, whom, by every click, add to the fortune of the admired. This has become the road to hell for some because it seems easy to do nothing and earn millions. So, technology is a double-edged sword that can be extremely useful when used right and extremely destructive when misused.

Technology and Education

The very first technological innovation was the invention of writing. After thousands of years of oral history telling and informal instructions, writing made it possible for humanity to begin to accumulate and pass each generation’s discoveries and technological progress to the next. Writing started an exponential increase in the advancement of new technologies, which led to new processes and economies. As such, writing was humanity’s most significant discovery. As new technologies were created and

found that students who had mobile phones or laptops present while a lesson was being taught scored five percent, or half a letter grade, lower on exams than students who didn't use electronics. Another study by Demirbilek and Talan (2018) showed that engaging in social media while trying to follow instruction may reduce learners' capacity for cognitive processing causing poor academic performance. Yet, another study indicated that a large number of university students are using social media with more focus on Facebook, which in turn negatively affects their academic results (Habes et al., 2018). Similarly, another study found that social networking negatively affects academic performance. In addition, the study revealed that strategic study approaches did not mediate the negative effect of social networking on academic performance (Rostaminezhad et al., 2019).

The rise of electronic gadgets and social media has undoubtedly contributed to lower grades and a reduced attention span. This, in turn, has been reflected in the drop-out rates among students (Arce, Crespo, & Míguez-Álvarez, 2015; Bennett, 2003; Heublein, 2014; Ortiz-Lozano, Rua-Vieites, Bilbao-Calabuig, & Casadesús-Fa, 2018). According to the Organization for Economic Co-operation and Development (OECD), one-third of higher education students drop out of their studies before they complete their first degree (OECD, 2009). The transition from upper secondary school to studies at universities and university colleges where students are left to themselves is difficult for many new students. To help the student to succeed in their studies, it is essential that universities respond to students' needs for academic and social interaction. So, the question becomes, what can educators do to remedy the situation? The answer seems to lie in the use of Supplemental Instruction (SI).

The Google Problem

According to Google, the number of searches per day has grown from 9,800 in 1998 to over 3.5 billion in 2019. It is the greatest tool for students. They regularly find answers to a myriad of questions, not all academic, of course. But, using the search engine regularly creates what is called the "Google Effect" or "digital amnesia," meaning the loss of a large block of interrelated memories. This means that Google becomes a personal memory bank (i.e., users cannot remember any information without looking it up). According to Steinhoff's (2016) study on college students' ability to recall information,

students who knew that they would be able to access the information easily online in the future could recall the process and place where to find it more easily. Yet, in return, these students also remembered less of the information itself.

In 2019, Firth et al. explored how unique features of the online world may influence a variety of factors. First, it may influence attentional capacities, as the constantly evolving stream of online information encourages divided attention across multiple media sources at the expense of sustained concentration. Second, it may influence memory processes, as this vast and ubiquitous source of online information begins to shift the

way knowledge is retrieved, stored, and even valued. Third, it may influence social cognition, as the ability for online social settings begins to resemble and evoke real-world social processes creates a new interplay between the Internet and social lives, including self-concepts and self-esteem. Overall, Firth et al. concluded that available evidence indicates that the Internet can produce both acute and sustained alterations in each of these areas of cognition, which may be reflected in changes in the brain. Also, neuroimaging of frequent Internet users shows twice as much activity in the short term memory as sporadic users during online tasks (Small et al., 2009). Basically, the brain is learning to disregard information found online, and this connection becomes stronger every time it is experienced. So the more Google is used, the less likely it is that information seen is retained.

As can be seen, technology is a double-edged sword that can aid students or hinder their studies. The problem of lack of focus and the effect of the Internet, especially Google or Wikipedia, has on long-term memory is a major problem that has to be solved. Meanwhile, teachers and academics have to assist students as best as possible. SI seems to be a good starting point.

Supplemental Instruction (SI)

Supplemental instruction is perceived as a way of approaching these pressing educational challenges (Jacobs et al., 2008). It is a program developed to support students in their learning process and aims to improve students' performance and reduce the drop-out rate. SI is a voluntary offering of facilitation and guidance provided by the students. It is about learning in collaboration with others, where the importance of relationships, involvement, and reflection as a method and tool for learning are emphasized. SI does not focus on weak students but on traditionally difficult courses with a high percentage of fail marks and poor exam attendance. In this way, SI is a program for everyone and is offered regularly. Since its beginnings in 1973, more than 1,500 universities in more than 30 countries have implemented the program in their institutions. The method is well described in different handbooks developed for SI (Arendale, 1994).

SI complements regular teaching in that advanced students guide new students. The activity is organized in groups of 8 to 15 students that meet weekly throughout the semester and is led by an SI leader. SI leaders are advanced students (selected students with an A or B in the subject) who receive SI executive training and are guided and observed by an SI supervisor. The role of the SI leader is not to be a teacher but to facilitate learning through guidance and to organize the program. The students work in collaborative groups, where they take responsibility for their learning through what is known as self-regulated learning. The SI program can also be adapted for public and private organisations, where the rapid technological change necessitates reskilling or rapid retraining of staff in new technologies or processes. Here, SI can become a useful and relatively affordable retention tool.

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