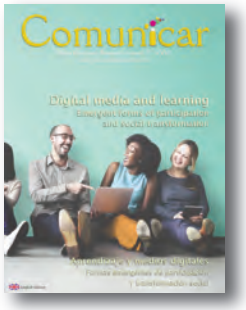
Comunicar, n. 58, v. XXVII, 2019 | Media Education Research Journal | ISSN: 1134-3478; e-ISSN: 1988-3478
www.comunicarjournal.com



Designing for deep learning in the context of digital and social media

El diseño para el aprendizaje profundo en los medios de comunicación sociales y digitales

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ABSTRACT
There is today a great deal of controversy over digital and social media. Even leaders in the tech industry are beginning to decry the time young people spend on smartphones and social networks. Recently, the World Health Organization proposed adding "gaming disorder" to its official list of diseases, defining it as a pattern of gaming behavior so severe that it takes "precedence over other life interests". At the same time, many others have celebrated the positive properties of video games, social media, and social networks. This paper argues that a deeper understanding of human beings is needed to design for deep learning. For the purposes of this study "design for deep learning" means helping people matter and find meaning in ways that make them and others healthy in mind and body, while improving the state of the world for all living things, with due respect for truth, sensation, happiness, imagination, individuality, diversity, and the future. In particular, fifteen features related to human nature are suggested based on recent scientific developments to answer the question: What is a human being? Consequently, proposals that are linked to learning and transformation, as well as social improvement, should fit with the ways in which humans, as specific sorts of biological and social creatures, learn best (or can learn at all) and can change for the better.

RESUMEN
En la actualidad existe una nutrida controversia en relación a los medios de comunicación sociales y digitales que ha llevado, incluso, a censurar la utilización de las redes sociales y los móviles por parte de líderes en la industria tecnológica. En este sentido, la Organización Mundial para la Salud ha propuesto añadir el «desorden del juego» a su listado de enfermedades, definiéndolo como un modelo de comportamiento de juego tan severo que se impone como «preferencia sobre otros intereses». Al mismo tiempo, distintos académicos han enfatizado los aspectos positivos derivados de las redes sociales y los videojuegos. En este artículo se argumenta que es necesaria una mejor comprensión del ser humano para poder implementar lo que aquí se define como diseño para el aprendizaje profundo. El «diseño para el aprendizaje profundo» está encaminado al reconocimiento de las personas y el desarrollo de sentidos saludables, individual y colectivamente, así como la mejora, en general, del estado del mundo para todos los seres vivos, según principios de verdad, felicidad, imaginación, individualidad, diversidad y futuro. En particular, se sugieren quince características basadas en desarrollos científicos que responden a la pregunta: ¿Qué es un ser humano? Consecuentemente, propuestas vinculadas al aprendizaje y la transformación y mejora social deben ser coherentes con dichas características que permiten definir cómo las personas, en tanto que organismos biológicos y sociales, aprenden o pueden aprender óptimamente, así como cambiar para mejorar.

KEYWORDS | PALABRAS CLAVE
Digital media, social media, learning theories, deep learning, active learning, collective intelligence, social change, participatory culture.
Medios digitales, medios de comunicación sociales, teorías del aprendizaje, aprendizaje profundo, aprendizaje activo, inteligencia colectiva, cambio social, cultura participativa.

Received: 2018-05-11 | Reviewed: 2018-06-06 | Accepted: 2018-08-01 | Preprint: 2018-11-15 | Published: 2019-01-01
DOI: https://doi.org/10.3916/C58-2019-01 | Pages: 09-17

1. Introduction

Today, our world faces many serious problems. We tend to approach these problems in terms of narrow silos of expertise. These problems are only amenable to deep understanding and possible solutions based on the intersection of a wide variety of areas of expertise. Over the last couple of decades, research in various disciplines has made significant discoveries about the nature of human beings, the human mind and body. When we put these areas together, we get a new picture of humans, one that is quite different from both our traditional academic views and our everyday ideas about ourselves.

In summary, this paper presents some findings about humans leading to a new answer to the old question "What is a human being?" based on contemporary research. In turn, this answer may well fuel a deeper understanding of digital and social media in society while enabling its effective use for deep learning. For the purposes of this study, "deep learning design" is defined as design that helps people matter and find meaning in ways that make them and others healthy in mind and body, while improving the state of the world for all living things, with due respect for truth, sensation (pleasure and pain), happiness, imagination, individuality, diversity, and the future. Much of the design in our world serves no such goal. Sometimes this is so because designers intended to design for "misguided purposes". In other cases, designers' intentions are good, but their design is aimed at a mistaken idea of what humans are, thus missing the mark.

2. What is a human being?

Based on contemporary research, some features of human nature are suggested. This is not an exhaustive literature review on this complex topic. Rather, it is a general picture that describes some human traits according to certain scientific developments.

1) Mattering: Humans have a deep biological and psychological need for mattering or counting, to feel that what they do and think matters to others. When they feel they do not count, mental and physical illness often arises, as well as violence to self or others in some cases (Gee, 2000; Marmot, 2004; Wilkinson & Pickett, 2006).

2) Tropic to meaning (not truth): Humans have a deep biological and psychological need to feel that things are meaningful, make sense, and happen for a reason. This need for mental comfort regularly trumps truth for humans (Bruner, 1990; Gee, 2017a; Lázaro & Esteban-Guitart, 2014).

3) Humans as complex systems: Humans have a brain in their head and another one in their gut (and wherever else the vagus nerve navigates, such as the heart and lungs). In fact, more signals go from the gut-brain to the head brain than vice-versa. The human body, and especially the gut, contains trillions of microorganisms that affect how we think and feel, but they are not "our" cells, though they make up 90% of "us". Human thinking, feeling, and physical/mental well-being are products of very complex interactions between our head and gut brains, our bodies, chemistry, microorganisms, and the myriad features present in the physical and social environments through which we move (Harris, 2018; Woolfson, 2016; Yong, 2016). In that regard, see the work on epigenetics (Sapolsky, 2017).

4) Lost without feeling: Humans attach affect to facts and choices. If they do not do so, then they do not retain or care about facts and cannot decide or choose. Therefore, thinking and feeling are integrally related; they function as a team and are often inert or dangerous when separated (Gray, Braver, & Raichle, 2002; Immordino-Yang & Damasio, 2007; LeDoux, 1998; Richards & Gross, 2000).

5) Limited insight: Humans are consciously aware of only a very small part of their motivations and reasons for acting and feeling. A great many modules in the brain process information and send decisions about actions and feelings (but not the reasons for them) to an interpreter module (the conscious part of the brain). In turn, the interpreter makes up a good story about our actions and feelings on the basis of quite limited overt information. Humans are good at confabulating reasons to explain their actions and feelings in the absence of any real evidence, a fact of which they are mostly unaware (Gantman, Adriaanse, Gollwitzer, & Oettingen, 2017; Gazzaniga, 2010; Pinto, de-Haan, & Lamme, 2017).

6) Brain bugs: Humans are prone to a number of "brain bugs", one of the most significant of which is "confirmation bias". Confirmation bias means that humans have a strong tendency to look for and only consider evidence that reaffirms what they already believe and discount evidence that disproves their beliefs. This effect is not lessened for educated people; education does not eradicate it and may even make it worse (Delgado, 2012; Legare, Schult, Impola, & Souza, 2016).

7) Poor memory: Human memory is more future-oriented than focused on the past. It is primarily used to plan

for future actions. Every time we use memory, we change it. As an accurate record of the past, human memory is quite unreliable, though we humans are often unaware of this fact, and its implications for society at large and the legal system in particular. Human memory resembles a simulation device to pre-plan and imagine rather than a recording device (Glenberg, 1997; Klein, Robertson, & Delton, 2010; Seligman, Railton, Baumeister, & Sripada, 2016).

8) Self-defeating optimization: Humans will usually try to optimize any situation to their short-term desires and benefit, right up to ruining the situation for others and even themselves. Examples: if a game is designed to teach reading, many young people will do all they can to play and win the game without actually reading. Cheating in a multiple-player game up to the point where no one plays it anymore; getting into college and then seeking the easiest courses, graders, and doing the least amount of work possible while avoiding any hard learning (Cosmides, 1989; Rhode, 2017).

9) Us vs. them: Humans are inherently prone to think and act in terms of "us" versus "them". This effect, which stems from human evolution, is very often exacerbated by culture and society, and it is intensified when people feel threatened or disdained (Gee, 2017b; Sapolsky, 2017; Taylor & Lobel, 1989).

This paper represents a contribution to contemporary debates on digital and social media. It advances a theoretical articulation about human beings in order to understand how deep learning works, and how to design for positive, effective deep learning experiences for humankind.

10) Pattern recognizers gone wild: Humans are pattern-recognizers par excellence. They can find patterns and act on them where none exist (think astrology; signs of the "end times"; gambling; stock pickers; stereotypes; and all the people who mistake correlation for causation). Without guidance, human pattern recognition can be dangerous to all concerned, no matter how creative it may seem. Teaching can, if not done well and morally, dampen innovation and "colonize" the learner (Lara-Dammer, Hofstadter, & Goldstone, 2017).

11) The difficulty with "Hard problems": The world today faces deep and hard problems stemming from dangerous interactions between different complex systems affected by human behaviors. These problems are not amenable to solutions based on anyone silo of expertise, though that is often how we try to approach them. Narrow experts over-trust what they know and discount what they ignore (Jenkins, 2006; Nielsen 2012).

12) Limitations of individual intelligence: A great deal of human thinking and deciding works best when it is off-loaded to good tools, collaborations with others, and human-engineered environmental structures and designs. Humans are "plug-and-play" devices that only work well when plugged into diverse people, smart tools, and well-designed environments. Left to their own devices, humans can be dangerous to themselves and others (Levy, 1999; Navarro, 2009; Ricaurte-Quijano & Álvarez, 2016; Perkins & Salomon, 1989).

13) School ineffectiveness: School is largely ineffective in terms of long-term retention by students. Skills learned in school are mostly forgotten once it ends, unless students practice them repeatedly. Humanities do not necessarily enhance life, considering that most people fail to engage them significantly after schooling. Moreover, there is seemingly no reason to believe that the humanities humanize human beings (Steiner, 1975). School largely serves to give people credentials that poorly correlate with their later success at work and in life, but get them in the door for a job or status (Arum & Roksa, 2011; Caplan, 2018; Pritchett & Beatty, 2015).

14) Corruption of powerful technologies: Technologies with great promise for learning, interaction, and activism tend to be corrupted by the marketplace –and human desires– to work in sub-optimal and even counter-productive ways. The setting into which technology is inserted (i.e., the capabilities and desires of people in situ) is more powerful in determining effects than the technology itself (Doyle, 2017; Hoffmann, 2017; Yudes-Gómez, Baridon-Chauvie, & González-Cabrera, 2018).

15) Diversity misunderstood: The ways in which humans think of diversity are largely factually wrong; however, they may be socially motivated and enforced. Groups like "black people", "white people", "African-Americans", "Jews", and many others, share fewer genes with each other than they do with people outside their group

(Rutherford, 2016). While humans think of diversity in binary terms (black/white; male/female; normal/abnormal; conservative/liberal), it is rarely truly binary. Real diversity exists at the level of people's everyday life experiences. People in socially constructed groups (like "races" or "genders") are different in several ways (Gee, 2017b; Jenkins, 2009; Marhiri, 2017; Sapolsky, 2017).

3. Relationships among human features

There are inherent connections among some of the fifteen features listed above. These connections point the way to how designers can use these features for either misguided design purposes or effective deep learning design. The most important connection exists among the first five features: mattering, tropic to meaning, humans as complex systems, thinking and feeling, and pattern recognition gone wild.

> Fifteen features regarding human beings are suggested to guide the design for deep learning. By "designing for deep learning" we mean helping people matter and find meaning in ways that make them and others healthy in mind and body while improving the state of the world for all living things, with due respect for truth, sensation (pleasure and pain), happiness, imagination, individuality, diversity, and the future.

People need to matter to others. Let's use "X" for any group or cause that makes a person feel they matter. X, in making the person matter, also enables the person to make sense and give meaning to things, thereby fulfilling feature 2. When humans lose their sense of mattering, they still seek meaning, but that search can become idiosyncratic, isolating, and even dangerous. When humans feel like they do not matter and cannot find meaning, their mind and body well-being suffers (feature 3), often due to stress and anxiety (Harris, 2018; Marmot, 2004; Wilkinson & Pickett, 2006).

Humans prefer mattering and meaning to truth in and of itself. Furthermore, they will value truth only when they can attach affection to it. What makes mattering and meaning-finding so crucial for humans is that it melds affect and information (whether it be true or false). Humans' super-power is pattern-recognition, and they actively seek out (however spurious) patterns that make them feel good (regarding mattering, meaning, and self-interest).

Feature 3 is crucial here. When we pay attention separately to the (head) brain, and treat the body (as "brainless"), and consider environments as out there, separate from us, we miss all the real action with humans. Each human is a "multiple-brained-genetic-cognitive-emotional-chemical-epigenetic-social-interactional-environmental complex systems" (Harris, 2018; Sapolsky, 2017). Everything interacts with and co-creates everything else. When humans feel they do not matter and are isolated from shared meaning, the complex system, as a whole, goes away, not just one piece of it. Chronic stress/anxiety is one of the outcomes, and its effects spread throughout the whole system with deeply negative results (Harris, 2018). It is barely helpful to design good schools, good learning, or good media for people who are highly stressed in this way. Such people pay little attention to anything other than the threats to their integrity as a worthwhile person.

The following three features are also profoundly connected: limited insight, brain bugs, and poor memory. Humans are complex systems (partially) run by a driver (consciousness, the interpreter) with minimal insight (too much else is going on under the hood of the system beyond a person's conscious awareness) and very poor memory in the sense of "a veridical record of the past". Brain bugs, like confirmation bias, work well for relatively stable environments, like the ones in which we evolved as creatures. In these environments, it is smart to trust what one already knows. Moreover, brain bugs do not work for the rapidly changing and complex environments of the modern world. The solutions to these problems are to be found in dealing with feature 12, which we will discuss below.

It is essential to see, regarding the feature set 5-7, that humans are built to be more future-oriented than past-oriented. If an inaccurate memory facilitates good future choices, then it is more valuable than an accurate one that does not. People store edited versions of their experiences in their long-term memories and use these memories (in

bits, pieces, and various transformations) to think, plan, and choose (Gee, 2017a; Seligman, Railton, Baumeister, & Sripada, 2016). People cannot think, plan, or choose well without a large amount of good, rich experiences to use as fodder for imagination and simulations in their minds. However, as they gain experiences and learn to use them fruitfully for imagination and simulations, they need help, in the form of good tools, good practices, and good teaching, to make up for their limited insight and brain bugs.

The following features are also integrally connected to each other: Self-defeating optimization and Us vs. Them. These are both features that are connected to human beings favoring short-term advantage over long-term advantage and favoring self-advantage over advantaging others, as well. Humans are selfish, though this selfishness often displays itself as favoring "kin" or "people like us" over others, and not just the self alone. They are also built to favor short-term gain over long-term gain. Both of these properties evolved in us because, under the conditions in which we evolved (as hunter-gatherers), they were good for survival (Tomasello, 2014). People do not engage in delayed gratification when food is scarce. Also, "us" is all important when there are not many "them" around, and we have no real idea whether "they" are "safe" or not. Neither of these features is particularly good in a world replete with short-term pleasures that will kill in the long run, which is much longer for modern humans, and replete with a massive array of "strangers" in "your" very own society.

Now, we arrive at a set of features that capture the problem with humans at the larger levels of society and institutions. Human intelligence is quite limited at the individual level, as we have seen. However, humans can accomplish mighty deeds (like bridges and wars) when they act collectively with proper tools. However, problems arise here as well. Since technology effects are largely due to the contexts (concerning human capacities, desires, and cultures) in which they are placed, technologies tend to become "corrupted" by the short-term desires of human beings (Coker, 2018). When we use technology to speak to a problematic situation, that situation itself often undoes the technology or recruits it to serve the problem and not serve as a solution to the problem.

Collective intelligence, in its modern sense, requires pooling diversity and using good tools to recruit as much knowledge, experience, and creativity as we can. Although human society and institutions are most often organized around silos of expertise protecting their boundaries and "rights". Furthermore, diversity in society and academic world, it is most often defined (and defended) in terms of big groups and binaries that do not represent the level of difference and diversity that fuels collective intelligence. That diversity level is achieved when a person has lived the interaction of all their social groups and identities, filtered through their unique personhood, in a myriad of diverse lived experiences that have given them their own quite situated and specific insights, knowledge, perspectives, and vital contributions to make (Gee, 2017b; Marhiri, 2017).

We often believe that it is the job of schools and schooling to speak to the issues we have been discussing. However, abundant work in economics has shown that the effects of school are quite transitory for the most part (Caplan, 2018). Students soon forget most of what they learn in school, unless they continue to practice it as part of their daily lives or on the job. Work leads to skills, not school, for the most part. Moreover, the humanities do not seem to humanize, given how few people make much use of them later in life, and how much damage well-educated people do in the world.

Economists have argued that a large percentage of the school system (though not all of it) functions only to signal to employers who will be intelligent, conforming, and conscientious workers, based on the amount of drudgery they could endure while in school, especially in the process of getting credentials and degrees. In reality, school speaks very little to the human problems we have surveyed. After all, the vast majority of people whose digital and social media habits we bemoan are or have been in school.

The final set of connected features, below, are those that point to the beginnings of a solution: difficulty dealing with hard problems, limitations of individual intelligence, school ineffectiveness, corruption of powerful technologies, and diversity misunderstood.

If we want to use technology to design for deep learning –and therefore design for humans as they are rather than as we imagine them– we have to reverse features 11-15. We must stop new technologies from being corrupted in situ. We have to recruit the full range of actual diversity. We need to engage in transdisciplinary perspectives to deal with hard and complex problems, not just isolated narrow areas of specialization alone. We are required to supplement and expand –not contract– human intelligence via adequate tools, effective forms of collaboration and collective intelligence, and life-enhancing social networks. In addition, we have to realize that the solution is not at school –or only at school– at least, not remotely in the schools we have, have had, and probably, for the most part, will always have.

4. Design for deep learning: Our challenge

Having said all that, we would like to consider a tentative suggestion about how to think about designing (whether it is a blog, a game, an app, a video, a website) effectively for humans as they are.

Perhaps the most profound urge for humans is to affiliate themselves with an idea, a cause, or an endeavor that can give their lives meaning and make them matter to others and to themselves. Humans have a choice when faced with misguided, flawed design or effective, deep learning design. Designing for deep learning means enticing people to affiliate with something that enhances their lives and those of others, as well as our shared world. When people join a cause, idea, or endeavor, they usually do so in a social context as part of a group of people with whom they share this interest. Most people gain their sense of mattering socially, concerning others who also matter to them.

Indeed, learning and development are consequences of social participation in affinity spaces. By "affinity space" we mean a site/space that may be virtual, physical or both, where people interact with each other and have access to resources that enable their engagement in a shared activity in which participants have a common interest. Each of these spaces, for example, a social activism webpage, is part of a larger affinity space comprised by smaller ones (just like a state is made up of towns and cities). The linked spaces, or space of spaces through which people move to learn deeply and to become someone new, are a real ecosystem that changes over time and expands knowledge and identity. Not everything that happens in these linked spaces –and not every journey through them– is positive. The balance between good and evil is always shifting. Design for deep learning must be for the long haul, must be continuous and must eventually become a joint endeavor with a social push for good that can be self-correcting in the face of change and crisis.

People, for example, visit a blog or website to have an experience; essentially, they want to see if there is anything they can learn (and become) in the site that will add value to their lives. Humans do not learn well from "anything goes" experiences, especially when they are newbies. Therefore, the designer should create an experience that will lead to deep learning. This, of course, is not easy because good or deep learning involves effort and risk, so it is harder than trivial learning or learning that plays to our weaknesses and prejudices. According to Gee (2017a), humans dislike doing hard things, except under certain special conditions. In any case, the experience is good for deep learning for humans when:

a) They have a clear, but perhaps, changeable goal.

b) The goal requires an action (or set of actions) that the learner emotionally cares about (for humans, the most effective form of caring –for learning and thinking– is when something is "at stake" for them).

c) Something (i.e., stuff you design) helps them, especially if they are "newbies", to manage their attention in fruitful ways so that they are aware of what is important and useful amidst the myriad of elements that compose any human experience.

d) They are encouraged to try different things and to see failure as an important form of learning.

e) It helps them discover the appropriate values and judgments they can use to assess their progress through various tries, retries, and failures. This often means internalizing the norms of a group of people, some of whom have become adepts or experts at a given endeavor. This internalization process is necessary (though it can also be a type of "colonizing" or "policing"). However, the ultimate goal is to go beyond the internalization of norms to produce people who eventually learn how to improve and transform the norms.

Productive learning spaces allow participants to continuously co-design (customize, change, improve) the site or activity, what is in it, and the experience the site-activity affords (Esteban-Guitart, Coll, & Penuel, 2018; Jovés, Siqués, & Esteban-Guitart, 2015). The goal is for participants to become residents and co-owners (as well as "self-directed teachers" and "designers" in their own right). An experience for humans, when it is well designed, is placed into long-term memory in a way that is well-integrated with other memories. This memory and its elements are used as materials for simulating the future so that people can plan, dream, and make better choices to improve their future. This means that assessment of the site-activity success should not be based on how much people retain (or recall), but rather on how much better they get as choosers for better futures (Cutumisu, Blair, Chin, & Schwartz, 2015). In other words, space and/or activity fosters the construction of imagination, not (just) memories, by getting people to feel they matter (to others) and to find meaning (for things to make sense) through affiliation to a shared cause, idea, or endeavour connected to something good. In that context, the role of the "teacher" is to guide learners through a fruitful learning experience rather than to teach something. In other words, teachers become a resource for people's self-teaching and self-directed learning. Following early Vygotsky (1997: 47): "Ultimately, the child teaches himself", and the teacher's role becomes to direct and guide the environment as a way to promote certain

behaviors and reactions. According to the principles described above, it can be said that the space-site-activity should be full of resources with tools, technologies, and interactional social practices that supplement and transform the limits of human intelligence. This essentially involves designing for collective intelligence, a phenomenon that, of course, requires groups of people to take charge of their fruitful collaborations. There is now a large literature on different forms of collective intelligence and "wisdom of the crowd" (Levy, 1999; Navarro, 2009; Ricaurte-Quijano & Álvarez, 2016; Perkins & Salomon, 1989).

5. Conclusion

Deep learning and change are hard, and people will avoid them unless they are highly motivated to take on the challenge. The very basis of effective deep learning design is to attract and hold (some) people in space/site/activity through an emotionally-charged socially-shared "affinity" for a cause, idea, or endeavor and with the sorts of people who pursue that idea, endeavor, or cause. However, to truly motivate humans, that affinity needs "legs", it must offer to take them to better places, to transport them on a journey with others with whom they feel valued and vice-versa. To achieve this, it is necessary to connect the space/site/activity to other spaces/sites/activities, maybe many others that share, supplement, or enhance the affinity you are seeking to engender (Esteban-Guitart, Coll, & Penuel, 2018).

The space-site-activity should be full of resources with tools, technologies, and interactional social practices that supplement and transform the limits of human intelligence. This essentially involves designing for collective intelligence, a phenomenon that, of course, requires groups of people to take charge of their fruitful collaborations. There is now a large literature on different forms of collective intelligence and "wisdom of the crowd".

As people journey back and forth from the space/site/activity to others, they become fellow travelers on a path through life with others, a path they can share for a while or for a long time, a path from which they can branch off to new paths or a path they can take to the end. In the act, such design work can:

a) Make people matter to each other.

b) Direct their "us vs. them" urges as humans in wider and more meaningful directions -context is critical in how people think about who is "us" and who is "them" (Sapolsky 2017).

c) Get them to attach feeling (affect) to the truth by storying it as a cause, a journey, a direction, a shared mission for good.

d) Make people healthier in mind and body due to the connections between mattering, meaning, and health for people and society.

In the end, designs for deep learning are travel agents sending people on life-enhancing, world-enhancing journeys.

Although designing for deep learning is hard because humans often dislike effort, there is some hope here. Decades ago, Harry Harlow, the scientist who did the (in)famous wire monkey studies, was testing the intelligence of primates. This was done by giving a monkey a mechanical puzzle and seeing how well the monkey could solve the puzzle. Since psychologists at the time were good behaviorists, they placed an edible reward under each part of the puzzle, assuming that the reward for solving each part of the puzzle would encourage the monkey to keep working on the puzzle (i.e., they used continuous rewards to deal with the effort problem). However, one day, Harlow wondered what would happen if there were no food rewards (Harlow, Harlow, & Meyer, 1950). The assumption was the monkey would stop trying to solve the puzzle, and that working on it would not be worth the effort to the monkey yet. Harlow tried it anyway. He found that without rewards, the primates solved the puzzles quicker than they did with rewards. For primates, learning is a reward all on its own; primates, and particularly humans, have a biological urge to share, ask, learn and solve problems (Bruner, 2012; Tomasello, 2014).

Humans are primates. Schools and inequity in society have killed the psycho-biological love of learning, epistemological sensitivity (Bruner, 2012) and problem-solving for many people. We humans have lots and lots of hard problems to solve. Maybe the "designing for deep learning" problem is not really that humans do not like effort, but rather, that they need to discover who they are: beings that thrive on effort and learning when they sense rays of light and hope.

Funding Agency

This work was supported by the Spanish Ministry of Economy, Industry, and Competitiveness (MINECO), the Spanish State Research Agency (AEI) and The European Regional Development Fund (European Union) [grant number EDU2017-83363-R].

References

Arum, R., & Roksa, J. (2011). Limited learning on college campus. *Society, 48*, 198-203. https://doi.org/10.1007/s12115-011-9417-8

Bruner, J. (1990). *Acts of meaning.* Cambridge, MA: Harvard University Press.

Bruner, J. (2012). What psychology should study. *International Journal of Educational Psychology, 1*(1), 5-13. https://doi.org/10.4471/ijep.2012.01

Caplan, B. (2018). *The case against education: Why the education system is a waste of time and money.* Princeton, NJ: Princeton University Press. https://doi.org/10.23943/9781400889327

Cosmides, L. (1989). The logic of social exchange: Has natural selection shaped how humans reason? *Studies with the Wasson Selection task*. *Cognition*, *31*(3), 187-276. https://doi.org/10.1016/0010-0277(89)90023-1

Coker, C. (2018). Still the human thing? Technology, human agency and the future of war. *International Relations*, *32*(1), 23-38. https://doi.org/10.1177/0047117818754640

Cutumisu, M., Blair, K.P., Chin, D.B., & Schwartz, D.L. (2015). Posterlet: A game-based assessment of children's choices to seek feedback and to revise. *Journal of Learning Analytics, 2*(1), 49-71. https://doi.org/10.18608/jla.2015.21.4

Delgado, M.R. (2012). A brain bug's life. *Trends in Neurosciences*, *35*(4), 209-210. https://doi.org/10.1016/j.tins.2012.02.002

Doyle, T. (2017). Weapons of math estruction: How big data increases inequality and threatens democracy by Cathy O'Neil. The Information Society. *An International Journal*, *33*(5), 301-302. https://doi.org/10.1080/01972243.2017.1354593

Esteban-Guitart, M., Coll, C., & Penuel, W. (2018). Learning across settings and time in the digital age. *Digital Education Review*, *33*, 1-16.

Gantman, A.P., Adriaanse, M.A., Gollwitzer, P.M., & Oettingen, G. (2017). Why did I do that? Explaining actions activated outside of awareness. *Psychonomic Bulletin & Review*, *24*(5), 1563-1572. https://doi.org/10.3758/s13423-017-1260-5

Gazzaniga, M. (2010). Cerebral specialization and interhemispheric communication: Does the corpus callosum enable the human condition? *Brain*, *123*(7), 1293-1326. https://doi.org/10.1093/brain/123.7.1293

Gee, J.P. (2000). Identity as an analytic lens for research in education. *Review of Research in Education*, *25*, 99-125. https://doi.org/10.2307/1167322

Gee, J.P. (2017a). *Teaching, learning, literacy in our high-risk high-tech world: A framework for becoming human*. New York: Teachers College Press.

Gee, J.P. (2017b). Identity and diversity in today's world. *Multicultural Education Review*, *9*(2), 83-92. https://doi.org/10.1080/2005615X.2017.131221

Glenberg, A.M. (1997). What memory is for? *Behavioral and Brain Sciences*, *20*(1), 1-19. https://doi.org/10.1017/S0140525X97000010

Gray, J.R., Braver, T.S., & Raichle, M.E. (2002). Integration of emotion and cognition in the lateral prefrontal cortex prefrontal cortex. *Proceedings of the National Academy of Sciences*, *99*(6), 4115-4120. https://doi.org/10.1073/pnas.062381899

Harlow, H.F., Harlow, M.K., & Meyer, D.R. (1950). Learning motivated by a manipulation drive. *Journal of Experimental Psychology, 50*(2), 228-234. https://doi.org/10.1037/h0056906

Harris, N.B. (2018). *The deepest well: Healing the long-term effects of childhood adversity*. New York: Houghton-Mifflin.

Hoffmann, A.L. (2017). Breaking bad algorithms. *Science*, *358*, 310-311. https://doi.org/10.1126/science.aao4414

Immordino-Yang, M.H., & Damasio, A. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education. *Mind, Brain and Education*, *1*(1), 3-10. https://doi.org/10.1111/j.1751-228X.2007.00004.x

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: NYU Press.

Jenkins, H. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. Chicago: MacArthur Foundation.

Jovés, P., Siqués, C., & Esteban-Guitart, M. (2015). The incorporation of funds of knowledge and funds of identity of students and their families into educational practice. *Teaching and Teacher Education*, *49*, 68-77. https://doi.org/10.1016/j.tate.2015.03.001

Klein S.B., Robertson T.E., & Delton A.W. (2010). Facing the future: Memory as an evolved system for planning future acts. *Memory and Cognition 38*, 1, 13-22. https://doi.org/10.3758/MC.38.1.13

Lara-Dammer, F., Hofstadter, D.R., & Goldstone, R.L. (2017). A computer model of context-dependent perception in a very simple world. *Journal of Experimental & Theoretical Artifical Intelligence*, *29*(6), 1247-1282. https://doi.org/10.1080/0952813X.2017.1328463

Lázaro, L., & Esteban-Guitart, M. (2014). Acts of shared intentionality. In search of uniquely human thinking. *Ethos*, *42*(2), 10-13. https://doi.org/10.1111/etho.12066

LeDoux, J.E. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience*, *23*, 155-184. https://doi.org/10.1146/annurev.neuro.21.1.155

Legare, C.H., Schult, C.A., Impola, M., & Souza, A. (2016). Young children revise explanations in response to new evidence. *Cognitive Development*, *39*, 45-56. https://doi.org/10.1016/j.cogdev.2016.03.003

Levy, P. (1999). *Collective intelligence: Mankind's emerging world in cyberspace*. New York: Basic Books. https://doi.org/10.1162/leon.1999.32.1.70b
Marhiri, J. (2017). *Deconstructing race: Multicultural education beyond the color-bind*. New York: Teachers College Press.
Marmot, M. (2005). Social determinants of health inequalities. *Lancet*, *365*, 1099-1104. https://doi.org/10.1016/S0140-6736(05)71146-6
Navarro, M.G. (2009). Los nuevos entornos educativos: Desafíos cognitivos para una inteligencia colectiva. [New educational settings. Cognitive challenges for the realization of a collective intelligence]. *Comunicar, 33*, 141-148. https://doi.org/10.3916/c33-2009-03-005
Nielsen, M. (2012). *Reinventing discovery: The new era of networked science.* Princeton, NJ: Princeton University Press. https://doi.org/10.1515/9781400839452
Perkins, D., & Salomon, G. (1989). Are cognitive skills context-bound? *Educational Researcher, 18*(1), 16-25. https://doi.org/10.3102/0013189X018001016
Pinto, Y., de Haan, E.H.F., & Lamme, V.A.F. (2017). The split-brain phenomenon revisited: A signle conscious agent with split perception. *Trends in Cognitive Sciences*, *21*(11), 835-851. https://doi.org/10.1016/j.tics.2017.09.003
Pritchett, L., & Beatty, A. (2015). Slown down, you're going too fast: Matching curricula to student skill levels. *International Journal of Educational Development*, *40*, 276-288. https://doi.org/10.1016/j.ijedudev.2014.11.013
Rhode, D. (2017). *Cheating: Ethics in everyday life.* New York: Oxford University Press.
Ricaurte-Quijano, P., & Álvarez, A.C. (2016). The wiki learning project: Wikipedia as an open learning environment. [El proyecto Wiki Learning: Wikipedia como entorno de aprendizaje abierto]. *Comunicar, 49*, 61-69. https://doi.org/10.3916/C49-2016-06
Richards, J.M., & Gross, J.J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*(3), 410-424. https://doi.org/10.1037/00223514.79.3.410
Sapolsky, R.M. (2017). *Behave: The biology of humans at our best and worst*. New York: Penguin.
Seligman, E.P.M., Railton, P., Baumeister, R.F., & Sripada, C. (2016). *Homo prospectus.* New York: Oxford University Press.
Steiner, G. (1975). *After Babel: Aspects of language and translation*. Oxford: Oxford University Press.
Taylor, S.E., & Lobel, M. (1989). Social comparison activity under threat: Downward evaluation and upward contacts. *Psychological Review, 96*(4), 569-575. https://doi.org/10.1037/0033.295C.96.4.569
Tomasello, M. (2014). The ultra-social animal. *European Journal of Social Psychology, 44*(3), 187-194. https://doi.org/10.1002/ejsp.2015
Vygotsky, L.S. (1997). *Educational psychology.* Boca Raton, FL: St. Lucie Press.
Wilkinson, R.G., & Pickett, K.E. (2006). Income inequality and population health: A review and explanation of the evidence. *Social Science & Medicine, 62*(7), 1768-1784. https://doi.org/10.1016/j.socscimed.2005.08.036
Woolfson, A. (2016). Mob rule. *Nature*, *536*, 146-147. https://doi.org/10.1038/536146a
Yong, E. (2016). *I contain multitudes: The microbes within us and a grander view of life*. New York: HarperCollins.
Yudes-Gómez, C., Baridon-Chauvie, D. & González-Cabrera, J.M. (2018). Cyberbylling and problematic Internet use in Colombia, Uruguay and Spain: Cross-cultural study. [Ciberacoso y uso problemático de Internet en Colombia, Uruguay y España: Un estudio transcultural]. *Comunicar, 56*, 49-58. https://doi.org/10.3916/C56-2018-05