Review Article

Changing Educational Landscapes: Student Learning, Artificial Intelligence and the Attention Economy

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Abstract: Artificial Intelligence (AI) and the Attention Economy are both having profound effects on the way we live and learn. It is their interactions that are producing major changes in the way that new generations are developing mentally, emotionally and educationally. This paper is concerned with enabling and developing student learning and coping mechanisms against the background of the AI-driven Attention Economy. Several current and emerging problems, rooted in the interaction between AI and the Attention Economy, which affect student learning and personal development, are considered. These include the areas of attentional capacity, memory processes and social cognition. The important role of self-awareness for student development and autonomy in this changing learning process is considered, especially in the light of the recent update of the framework for 21st Century Learning by the Center for Curriculum Redesign. The development of artificial intelligence and the possibility of providing AI-based Individual Learning Assistants which would work alongside the students, rather than acting as a feeder of personal data to the major technology companies is also discussed. Two separate themes emerge which are the potential uses of AI to improve education and the much broader societal educational, anxiety and mental health issues outlined by Jonathan Haidt, and most impacting those born after 1997 (Gen Z and Gen Alpha). The major issues of each theme are presented and discussed before potential solutions are briefly outlined. The latter includes consideration of the extensive implementation of a ban on smart phone use in Australia's public schools from the start of 2024.

Keywords: Self-awareness, student development, artificial intelligence, attention economy.

1. Introduction

This paper is concerned with enabling and developing student learning and coping mechanisms against the background of the

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AI-driven Attention Economy. Several current and emerging problems presented for student learning and personal development by the Attention Economy are considered. These include the areas of attentional capacity, memory processes and social cognition [1]. The attention economy works on the premise that, because of the huge increase in the amount of information available in daily life, attention has

become a scarce resource and valuable commodity [2]. Developments in communications technologies and artificial intelligence have enabled companies to harvest vast amounts of data on each individual. This data, comprising extensive social and psychological profiles of technology users, are the products that are then sold by the major technology companies to all types of commercial and organizational entities that can profit from their use. Communication technologies such as conferencing platforms, smartphones, podcasts, blogs and social media platforms have improved our daily lives and made communicating much easier – and can be powerful and effective tools in enhancing learning. However, for students and adolescents, the constant distractions available with in-class and out-of-class use of smartphones, tablets, and laptops can disrupt their learning and progress during a key developmental period.

For our high school students, adolescence is a hugely important period in terms of brain maturation and development. Changes in the structure of the brain, its functions and connectivity mean that adolescence is:

"A period of opportunity to discover new vistas, to form relationships with peers and adults, and to explore one's developing identity. It is also a period of resilience that can ameliorate childhood setbacks and set the stage for a thriving trajectory over the life course" [3].

The time-consuming distractions and stressful demands of coping and functioning effectively in the attention economy are a challenge to these developments. The same authors also point out that adolescence is a very important and dynamic time for brain development, "second only to infancy in the extent and significance of the neural changes that occur" [3].

Many studies have illustrated the negative effects on learning of unrestricted smartphone use in class, even when theoretically being used to promote learning [4, 5]. Consequently, we need to go further than looking at smartphone and laptop or tablet use and attempt to combat the motives and strategies behind the numerous

distractions provided by the drivers of the Attention Economy [6]. It is suggested that developing student self-awareness of their own cognitive and learning profiles and using these to develop meta-learning, agency, and the development of autonomously controlled personalized learning environments can help students to counter the more negative impacts of the Attention Economy at an individual level.

However, considerable evidence is also emerging of important generational impacts on learning and behavior in the AI-driven Attention Economy. Along with Tristan Harris, a former Google employee and design ethicist, Jonathan Haidt covered some of this ground in the documentary The Social Dilemma [7]. In the book "The Anxious Generation: How the Great Rewiring of Childhood Is Causing an Epidemic of Mental Illness" [8] social psychologist Haidt argues that major changes in how children play, over the last 30 years, basically from outdoor play with others to indoor phone-based play often alone, are causing serious learning and behavioral problems for the current generation of school students. This paper initially looks at emerging technologies and the attention economy, their impacts on the learning process, and some solutions that have emerged from educational professionals and organizations. It then takes a closer look at the concerns of Haidt, Harris, Orlowski and others that the current generation of student are actually, as a generation, learning less, and less effectively, than previous recent generations, directly as a result of the AI-driven Attention Economy.

2. The Attention Economy: Emergent Cognitive and Learning Issues

The Attention Economy was first defined by future Nobel-prize winning economist Herbert Simon, who commented in 1971 that:

"In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention" [2].

This observation has become increasingly pertinent for educators in recent years with the rise of social media, developments in AI and their combined impact on the learning process. The ability of social media companies to use AI algorithms to harvest detailed information on all facets of users' lives has given them the ability to build detailed profiles of each individual, especially their habits and their preferences in every aspect of their lives. This information is of enormous value to a whole range of companies and organizations and is specifically that which the big tech companies sell and profit most from. Consequently, large technology and social-media companies offer free search facilities plus high quality and entertaining content to attract and entertain users, especially younger users. A central idea is to keep users online as many times as possible and for as long as possible. Even sleep becomes a competitor. As Netflix CEO Reed Hastings was widely reported as stating:

"We are competing for our customers' time, so our competitors include Snapchat, YouTube, sleep, etc" [9].

The inclusion of sleep alongside more obvious commercial competitors can have a tremendous effect on student behavior and ability to learn, in terms of energy, focus, and concentration. In the classroom the impact of this on our students' learning and behavior can be readily seen. Annus [10] argues that because we live and work in a fast-changing VUCA world (volatile, uncertain, chaotic, and uncertain) we need to use time more efficiently and effectively. Annus argues that distractions and changes in many people's attention spans bring about a need to use brief presentations which are concise and exhibit extensive practical experience (echoing the social media content). This is then reflected in the classroom and the same author suggests that because of living in this dynamic, fast changing society, students attention spans are shortening:

"Students are impatient, often bored with explanations in class, and this is also true for home learning, as they do not like excessively long tutorial videos. This is largely due to the fact that people are used to fast, experiential, and generally high-quality content, and video content, in line with the trend today of TikTok videos, (which) delivers a large amount of impulses in a short period of time, losing the motivation to consume longer, more detailed content" [10].

2.1. Learning and Development Problems

With the enormous increase of individual use of smartphones and social media occurring in the past decade, the focus of much research has been on the impact of online behaviors on the social, psychological, and behavioral aspects of all citizens. For those of us involved in education, we are confronted with evidence of the impact and effects of smartphone and social media use on learning behavior, both inside and outside of class, on a daily basis. More importantly, in recent years, research scientists have been considering how these issues are affecting the functioning and structures of our brains, especially those of pre-teens and adolescents [1, 11-14]. Three areas of concern that are being considered are impacts on attentional capacities, memory processes, and social cognition.

2.2. Areas of Impact: Attentional Capacities

Over the past 10 years, educational providers have been confronted by much evidence of the power of the Internet and especially social media to capture the attention of our students. Even a dozen years ago more than 80% of teachers agreed with the statement "today's digital technologies are creating an easily distracted generation" [15]. Since then the constant stream of different forms of digital media and social media combined with each individual desire to be up to date with what is happening in their peer group, have seriously exacerbated this problem. Using the term "media multi-tasking," one author [1] commented that dealing with many inputs at the same time meant each one was only being attended to at a very shallow level. The never-ending stream of notifications, prompts, and online information all compete for our attention. For many, this results in attentional-switching, moving from one item to another in an often random fashion which replaces the focus and sustained attention needed to help learning occur.

2.3. Areas of Impact: Memory Processes

Group and teamwork are important activities for our students as they learn to share ideas and recognize different individual learning habits and perspectives. This is a form of "transactive memory" and has been a major part of how societies work and cooperate for thousands of years, using other people and objects (e.g., photographs) as a form of external, additional memory. We can see it in operation in a business simulation where members of the team will adopt different managerial positions, perhaps those most suited to their individual skills. The members each act as a form of external and shared memory for the group. With the increases of digital media to support learning, many students have become more reliant on knowing the location of information rather than understanding the information itself. In addition, having failed to commit information to long-term memory, the students do not get the benefits of being able to integrate and connect different sources [14]. This leads to increased "cognitive offloading" but with even more negative consequences as the level of cognitive resources allocated for remembering is reduced because of the knowledge that the information is readily available from an external source [1].

2.4. Areas of Impact: Social Cognition

It is perhaps in the area of social cognition that the most alarming changes are occurring. Social cognition involves a set of processes, unique to human beings, that enable us to understand and interpret social information. These processes then provide the queues for human beings to act appropriately in a given social environment. Social information processing requires focus and attention for correctly perceiving relevant cues [16].

As mentioned above, smartphone and web use can alter how students use transactive memory. The replacement of traditional forms of transactive memory also suggests fewer options for social interaction of a form useful in high school studies and other task-related activities. In a major review of related research, the authors commented:

"…the Internet is becoming a 'supernormal stimulus' for transactive memory - making all other options for cognitive offloading (including books, friends, community) become redundant, as they are outcompeted by the novel capabilities for external information storage and retrieval made possible by the Internet" [1].

In a study investigating how smartphone addiction might affect cognitive function and physical activity in middle-school children [17], the authors found that smartphone-addicted children had significantly lower levels of physical activity than non-addicted children. This indicates that smartphone addiction leads to reduced physical activity. As this reduced physical activity will often include the social activities involved in team games and two-person competitive games (badminton, tennis, etc.), this can lead to reduced socialization in the important life maturation period of adolescence.

3. The Attention Economy: Wider Social and Generational Impact

In his book "The Anxious Generation: How the Great Rewiring of Childhood Is Causing an Epidemic of Mental Illness," Jonathan Haidt [8] presents extensive evidence of the wider social impact of the AI-driven Attention Economy, especially in the USA and other Western countries. Haidt's central thesis is that the play-based childhood that human beings experienced for many thousands of years started to disappear in the 1980s and by 2010 had been replaced by the phone-based childhood, and that the latter has had and continues to have serious negative psychological and mental impacts on the generation born after 1995 (Gen Z).

The Social Dilemma documentary links these problem to the AI-driven Attention Economy and Harris suggests that the main goals of the large social media and communications technology companies are:

i) The engagement goal: to increase usage and to make sure users continue scrolling;

ii) The growth goal: to ensure users are coming back and inviting friends that invite even more friends;

iii) The advertisement goal: to make sure that while the above two goals are happening, the companies are also making as much money as possible from advertisements" [7].

In "The Anxious Generation", Haidt expands these themes and, among other major negative trends, presents data supporting claims that since 2010, 24/7 access to the Internet combined with the ever-increasing popularity of smartphones has caused almost 50% of teenagers in the USA to be almost constantly online. Haidt suggests, among other things, that some of the serious consequences of this ever-present, constantly in use interaction include a 92% increase in anxiety diagnoses in the 18-25 age group. In addition, in the UK, almost 40% of teenage girls who are using social media daily for more than five hours are categorized as clinically depressed in tests [8].

Haidt argues that overuse of social media and being online for long periods leads to children developing virtual experiences rather than interacting with their peers face-to-face and in real-time. Social media also brings the behavioral change of reducing interactions to the level of "likes" while often reducing teen self-confidence through the selfie culture of constant comparisons.

In contrast, in the daily offline lives of children, there is increased parental oversight and supervision. As a result of this over-supervision when offline, children do not have the opportunity to develop the experiences and skills that come with active, physical play with other kids and it is much more difficult for them to develop the greater levels of resilience needed to cope with daily life in their communities and society. Consequently, when we consider the educational issues in recent publications such as "Education for the Age of AI" [6] we also need to address the broader societal impacts of the attention economy on education, adolescents, and the wider communities.

3.1. Related Studies Learning and Development Problems Emerge

Other researchers reported similar problems, although on a smaller scale than posited by Haidt who considers the problems to be an urgent generational issue. In a research

report considering the problems of smartphone use among high school students, Spiratos and Ratanasiripong [18] reported smartphone addiction has been "associated with depression, stress, reduced self-esteem, and decreased academic performance". That report is specifically about the USA where 95% of American teenagers use smartphones regularly and have it fully integrated into their daily lives and routines. Haidt's findings are more widespread citing data on similar countries such as Canada, Australia, the UK, and several Western European countries. Haidt does comment that the impact has been less in East Asia. This could result from the greater support and importance of a more integrative social context and the extended family. Additionally, this could be related to the greater affluence of some Western countries and earlier technology adoption and the resultant impacts.

In a large-scale UN-supported study [19], which was related more generally to generational life happiness, the authors reported a significant decline in life satisfaction and happiness among adolescents from several major English-speaking countries. These countries included the United States, Canada, the UK, Australia, New Zealand, and Ireland. This was not the case for older generations whose life satisfaction and happiness generally rise with age. Consequently, the authors suggest that "*the U-shape in wellbeing by age that used to exist in these countries is now gone, replaced by a crisis in wellbeing among the young*". However, the authors, while recognizing that the decline in happiness started well before the COVID-19 pandemic, are not as assertive as Haidt and Harris in focusing on AI, social media, and smart phones as being the main causal factors and call for further research in what they recognize as a very complex area.

3.2. Counter Arguments

There have been several critical responses to Jonathan Haidt's claims, on both methodological grounds and also suggesting that the complexity of the problem requires more sophisticated analysis and complex

solutions. When reviewing the book for the UK based scientific journal Nature, psychologist Candice Odgers commented that:

"The book's repeated suggestion that digital technologies are rewiring our children's brains and causing an epidemic of mental illness is not supported by science. Worse, the bold proposal that social media is to blame might distract us from effectively responding to the real causes of the current mental health crisis in young people" [20].

Odgers has studied adolescents' mental health for the past two decades and has specifically looked to the relationship between digital-technology use and child and adolescent wellbeing over time,

University of Oxford academic psychologist Lucy Foulkes is also critical of Haidt's approach suggesting that his conclusions are the result of searching for simple solutions to complex problems. In her book "Coming of Age: How Adolescence Shapes Us" [21] the author points out that adolescence is probably the most misunderstood period of our lives. Foulkes draws on many years of expert research to better understand the complexities that help explain the real reasons why teens act in the ways that they do and concludes that it is "*an oversimplification to blame social media for the rise in adolescent mental health problems*".

4. Potential Solutions: Learner Centered and AI-Driven

The past three decades have also seen many changes in education as a response to movements towards student centered learning and from elite to mass systems of higher education [22]. The UK and Australia have, over a slightly longer period, increased the 17-21 age-group participation rates from around 10% to over 40%. Similar growth has been experienced in many countries. Across the world, between 2000 and 2020 participation rates in tertiary education doubled from 19% to 40% with some of the highest increases taking place in East and Southeast Asia [23].

The resultant huge increases in student numbers have been aided by education technology developments and globalization.

However, as would be expected with large and complex system changes, there have been emerging problems. There has been an enormous amount of organizational change in terms of numbers, processes, practices and participants from different backgrounds. The stresses and strains of moving from a teacher-centered learning model to a more student-centered learning model are still occurring in what is, in most countries, a very traditional sector and a slow changing part of society.

4.1 Using Learner-Centered Psychological Principles: Learner Profiles

Underpinning these increases in tertiary education has to be a successful and well managed high school system. In high schools in several countries, the influential "14 Learner-Centered Psychological Principles" of the American Psychological Association [24] has been a key contributor to the changes. The four main categories and the 14 principles which have supported the move towards more personalized and self-centered student learning are:

4.1.1. Cognitive and Metacognitive Factors (1-6): 1) Nature of the learning process; 2) Goals of the learning process; 3) Construction of knowledge; 4) Strategic thinking; 5) Thinking about thinking; and 6) Context of learning;

4.1.2. Motivational and Affective Factors (7-9): 7) Motivational and emotional influences on learning; 8) Intrinsic motivation to learn; 9) Effects of motivation on effort;

4.1.3. Developmental and Social Factors (10-11): 10) Developmental influences on learning; 11) Social influences on learning;

4.1.4. Individual Differences Factors (12-14): 12) Individual differences in learning; 13) Learning and diversity; 14) Standards and assessment.

APA Learner-Centered Psychological Principles: A Framework for School Reform & Redesign [25].

In the past three decades in the UK, Australia, and Vietnam, elements of these principles, especially Factors 1 to 6 (Cognitive and Metacognitive Factors), have been used to

design, develop, and implement a range of learner-centered courses or modules [26, 27], [28-30]. Central to each of the implementations has been the use of a student-centered methodology RAPAL (Reflective and Participative Approach to Learning) [28, 31].

A useful exemplar of this approach is provided by a range of courses in the area of personal and professional development taught in various forms in the International School of Management and Economics at the National Economics University, Hanoi from 2008 to 2024. The course levels range from pre-university to post graduate for degrees from Vietnam (NEU), the UK (Sunderland, UWE), and the USA (Boisie State). The initial course, titled "Learning at University" was first delivered to a group of 400 local pre-university students in Australia. It was primarily based on the use of the results of several psychometric tests, including cognitive style, personality type, and learning preferences to form a "cognitive profile" [31].

The above approach, based on the APA Learner-Centered Psychological Principles, integrated well with the Center for Curriculum Redesign's (CCR) important promotion of "Skills for the 21st Century: What Should Students Learn" [32] with its focus on the core higher level digital literacy (4C) skills of Communication, Collaboration, Critical Thinking, and Creativity. With major changes in the learning landscape over the past 10 years and the results of developments in artificial intelligence, the CCR has responded by asking the question: "Why, What, and How should students learn for the age of AI?" The response has been the 2024 publication of Education for Age of AI [6] which develops and updates the 21CL model and framework while remaining true to the 4C's original framework while emphasizing and integrating the important elements of metacognition and emotional intelligence (metaemotion) as meta-learning. The emphasis of meta-learning is adaptability with its justifications including, "Reflection must lead to better self-awareness and empathy in the service of adaptability for a rapidly changing world, which implies learning how to

learn continuously" and, "Adaptability is the ultimate differentiator, compared to AI" [6]. This echoes and supports the use of metacognition, learning profiles, and reflection to promote Flexible Student Alignment as the primary output of the RAPAL methodology discussed above [26, 28, 31].

4.2. Using AI Driven Learner Support Systems

One AI link with current developments is that this approach was based upon research for developing intelligent interfaces for the Internet [33, 34]. Considerable AI-based research throughout the 1990s was focused on the idea of developing personalized software agent-based interfaces to support student learning [35-37]. In the decade that followed, the initiative was taken up by big tech companies who identified the commercial advantages of monitoring the information accessed by users to provide detailed personal profiles illustrating the psychological, political [38], and, especially, purchasing preferences of each individual.

Currently, following the development of systems and apps such as Alexa, Cortana, Siri, and Google Home, interest in agent-based, user controlled, avatar-driven, personalized learning companions has returned. These personalized agent-driven systems could enable students to take back control of their own preferences, choices, and search results. The extent to which that control moves from the tech companies to the individual users remains to be seen. Nonetheless, a recent publication by the US-based Center for Curriculum Development [6] outlines an "AI learning Companion" as follows:

"AI has the potential to provide every student with their very own personalized learning companion, operating sometimes as a learning partner, other times as a guide through the mass of available learning opportunities, and sometimes as an instructor, all the time recording the student's interests and progress in their blockchain-protected, smart resume" (pp. 622).

This potential has existed for a considerable length of time, as indicated above [34, 36, 37], but the potential for increased agency in controlling the profiling of individual choices

moved from the individual (personal uses) to the software companies (marketing uses). Some progress has been made with the development of AI-based systems such as Intelligent Tutoring Systems which are AI-powered tutors providing personalized instruction and feedback. Although available for much of the past three decades, recent advances in AI have made them much more powerful and responsive [39]. Content Recommendation Systems whereby AI agents can recommend relevant learning materials to individuals or groups based on diverse student learning profiles and interactions [40]. This can also be applied at the group level with Collaborative Learning Platforms. With the latter systems, the AI agents can help make group learning more effective by pairing or grouping students according to their learning, complementary skills, and knowledge profiles [41].

However, one continuing problem is that despite the theoretical move to student- and learner-centered educational systems, in high school and university education, the teacher-centered model still dominates the design of the above AI systems. This is changing, but there still appears to be a reluctance to put more agency and control in the hands of the learners, especially at high school levels.

5. Conclusions

There are several elements that we need to consider when reviewing recent and emerging trends concerning self-awareness for student development in the AI-driven Attention Economy. The first of the two major themes is the impact of artificial intelligence on the education system itself, including the role of student self-awareness in optimizing the impacts of these effects.

Developing students' self-awareness of their own learning profiles and using this to develop the requisite skills, character, meta-learning, and agency as proposed in the Center for Curriculum Redesign's 4D framework [6] is a suitable way forward in enabling students to cope with some aspects of the AI-driven Attention Economy. Similarly, the development

of AI-based autonomous or agent-based Personalized Learning Environments (PLE's) could help students to take back at least some control over the results and implications of their online searches and more complex interactions with the web and all things digital in the educational learning space. This could also help counter the more negative impacts of the Attention Economy on learning at an individual level. Helping students to understand and develop their own self-awareness of how they learn individually through reflection, psychometric instruments, and questionnaires to develop learning profiles is a key element in the design of effective PLE's, in a similar manner to CCR's "AI Learning Companion" [6]. The process gives students more control and helps develop more autonomy in the learning process. This, in turn, helps students to be more involved and active in learning activities and enables them to flexibly adapt to the varying demands of different learning scenarios and tasks.

The second of the two major themes is perhaps wider and more significant, with important long-term societal implications. This is the impact of the AI-driven Attention Economy which is having such a major impact on the mental health and wellbeing of the current generation of younger students and learners (research shows that older generations are less affected and that by far the greatest impact has been on those born after 1995 [8].

Jonathan Haidt presents his arguments and thesis persuasively with strong supporting data. If Haidt and his well-informed and knowledgeable supporters such as the influential Tristan Harris and the Center for Humane Technology are correct, then there needs to be immediate and direct action. The initial solutions that Haidt calls for are summarized in his book as:

i) More unsupervised play: Allow children to gain social skills and become autonomous adults;

ii) No smartphones before 14: Limit usage to dumb phones;

iii) No social media before 16: Protect those in the most vulnerable stages of brain development;

iv) Phone free schools: Store devices in lockers to promote real-life interaction, connection and focus [8].

These are significant, broad, and wide-reaching suggestions which will be difficult to implement in the different sectors of different societies. However, initial bans or limitations on phones in schools have been introduced and implemented in several countries, states, and provinces starting with France in 2018, Australia, 2020, and Finland and the Netherlands 2024.

Despite the complexities of implementing Step 4 of the list suggested by Haidt above, Australia banned or restricted phone use in all public schools from the start of the school year in January 2024. The policies of the different states vary from locking phones away during school time to banning any classroom use. However, it is still unclear how effective the bans are.

In a review of 22 related studies looking at international evidence for and against banning mobile phones in schools [42], the authors commented that:

"While banning mobile phones in schools has taken different approaches and rationalized from either positive or negative standpoints, we have shown a significant lack of robust evidence on which to base sound decisions".

Recognizing the important role of smartphones and associated technologies and the social, educational, and professional lives of young adults, the authors argue that a better approach might be to educate young people to safeguard them from the present and emerging challenges related to new technology [42]. This once again leads us to the central role of self-awareness and agency in helping adolescents and high school students understand and cope with the demands and threats of the AI-driven attention economy.

Overall, when confronting the problems and implications of these important learning-related issues, it is argued that helping students to develop the self-awareness produced by the use of reflection and psychometric measures, in additional to the technology enhanced solutions outlined above, could be an effective measure in this process. It would enable students to be more involved and active in the learning process and give them greater insights into how and why they are changing and being pressured to change.

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