Adapting Maritime Education and Training (MET) Courses to the Digital Brains of the Millennial Generations

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There is mounting evidence that digital technology impacts brain development. As a result, the digital brains of the Millennial generations, which includes current and future generations of MET students, process information in a fundamentally different way. As a result, MET pedagogy and teaching must be adapted in order to accommodate both the preferential and biological differences in the current upcoming cohorts of learners. This paper explores some of the research that highlights the impacts of digital technology on neuroplasticity and examines a few possible teaching and learning techniques and strategies that might be employed in response to these changes.

Keywords: MET, Learning, Student-Centered, Digital, Millennial, Online, Technology

1.   Introduction

There is mounting evidence that digital technology impacts brain development. Relatively recent advances in brain scanning technology allow researchers to literally observe the brain in action. One of the most interesting developments is the concept of neuroplasticity, which is the brain's ability to reorganize itself and form new neural connections throughout life. [1] In addition to being able to compensate for damage and disease, the brain also exhibits neuroplasticity to adjust to new situations or new environments. For example, the neuroplasticity between readers who use an alphabet-based language (e.g., English) and those who use an image or character-based language (e.g., Chinese) are profoundly different. Similarly, these scans have revealed that the human brain reengineers it's neuroanatomy in response to the type of medium being used (e.g., writing using pen and paper versus using digital tablets like the iPad). Thus, neuroplasticity [2] helps to explain differences between book- and digital-reading brains. On the one hand, the traditional canonical practice of slow, sustained reading (i.e., deep book reading) imprints customized neural pathways. Alternatively, the continuous, partial attention intrinsic to digital reading cuts an alternative track of neural recalibrations. [3] According to developmental psychologist Maryanne Wolf: "We are not only what we read. We are *how* we read." [4] Therefore, it is no exaggeration to suggest that reading *is* biology and, as a result, we must adapt our teaching and learning practices.

2.   The Digital Brain

Just as the written word inevitably altered the human brain, through neuroplasticity, the digital brain (i.e., the human brain that predominantly reads and consumes information from digital media and online sources) is fundamentally different than the human brain before the advent of personal computing and digital technologies. The science behind exactly how the digital brain is different remains emergent, but it is important to note the differences observed from early studies.

In some ways the digital brain is advanced through digital technologies, including improved visual literacy, such as iconic representation, spatial orientation, special visualization, as well as multitasking and divided attention skills. [5] Although they are important, and vital in many professions, especially the maritime professions, digital technologies may also be creating gaps in other types of cognitive skill development. The following quote by Patricia Greenfield, a distinguished professor of psychology, highlights the challenge:

> Although the visual capabilities of television, video games, and the Internet may develop impressive visual intelligence, the cost seems to be deep processing: mindful knowledge acquisition, inductive analysis, critical thinking, imagination and

reflection. It is difficult for schools to teach reflective habits of mind to children whose informal education and cognitive socialization have not prepared them for this kind of learning and thinking. Yet, society needs reflection, analysis, critical thinking, mindfulness, and imagination more than ever. [5, p. 71]

As a result of these recent findings about the digital brain, MET educators need to address whether our teaching and pedagogy effectively meet the needs of students from the Millennial generations, also known as *digital natives*, whose cognitive socialization is fundamentally influenced by digital media/technology.

3.   Digital Natives

Cultural generations are cohorts of people who share the same life stage, live through the same economic, social, and political times; and are shaped by the same social markers and events. [6] Often, people are categorized by their generational cohort; while this leads to overgeneralization, it also serves to identify important stereotypical traits and behaviors. *Digital natives* (born after 1980) [7], also known as Generation Y or the Net Generation, grew up immersed in digital technologies (e.g., using personal computers, mobile devices, video games, social media, and the Internet) and are considered technologically adept/interested and digitally literate. [8] On the contrary, people born before 1980 might be considered to as *digital immigrants* or *digital adaptives* [9] since they largely grew up in an analog world and have had to adapt their ways to the growth of these digital technologies which were introduced during their lifetimes. It might even be said that the digital immigrants are DSL (i.e., *digital second language*) while the digital natives possess DFL (i.e., *digital first language* in tandem with their first spoken language).

The defining characteristics of digital natives have been described by many scholars [10], [11], [12], [13], [14]. The following is a summary of some of the key themes that Tappscott uses to define digital natives who are assertive, self-reliant, curious, and enmeshed in an interactive culture:
- *Fierce independence*: Their sense of autonomy derives from their experiences of being an active information seeker and creator of information and knowledge.
- *Emotional and intellectual openness*: The digital natives value the openness of the online environment, like anonymity, and communicate through numerous tools.
- *Inclusion*: They view the world in a global context and move toward greater inclusion of diversity.
- *Free expression and strong views*: With access to knowledge resources at their fingertips, the digital natives are assertive and confident.
- *Innovation*: This group is constantly trying to push the technology to its next level and figure out how to create a better world.
- *Preoccupation with maturity*: Armed with knowledge, they strive to be more mature than their predecessors.
- *Investigations*: Curiosity, discovery, and exploration are key for this generation.
- *Immediacy*: This generation views the world as 24/7 and demands real-time and fast processing.
- *Sensitivity to corporate interest*: Consumer savvy, these customers like customization and want to have options and to try before they buy.
- *Authentication and trust*: Net savvy individuals, they know the need to verify and check resources and authenticate people. [15]

Arguments have also been made that generation alone does not define digital fluency [16] and often gender, education, experience, and breadth of the use of technology play a role in defining if one is a digital native. For the purposes of this paper, since the biggest determinant of digital fluency is the degree of immersion in the digital environment (and that a large portion of the Millennial generations use the Internet and digital technologies as a first point of entry for information, communication, and knowledge – particularly in the developed world), the Millennial generations will be considered

digital natives. In cases where the Millennial generations are not digitally fluent, the current MET methods and pedagogies are likely sufficient.

4.   Learner-Centered Teaching

Much of the way in which MET has been shaped is based upon the book-reading brain of past generations. Skiba and Barton summarize this traditional type of education as follows:

> The traditional teaching paradigm, prevalent in higher education for many years, focused on the role of instructor as the "sage on the stage" who disseminated knowledge through lectures and PowerPoint slides. Brown [10] refers to it as the authoritarian, lecture-based model of education. This traditional teaching emphasized the acquisition of facts or, as Oblinger [17] noted, content-focused learning. Faculty from previous generations were text-based; focused on logical sequencing of knowledge; emphasized memorization, repetition, and recall; believed "one size fit all"; and saw the teacher as master and commander [18]. [19]
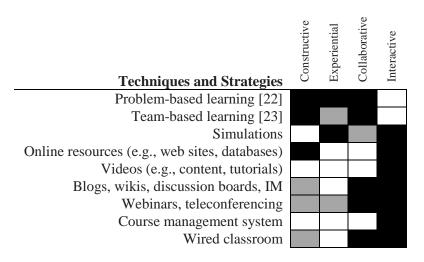
To accommodate the digital brains of digital natives, MET methods and pedagogies need to be adapted. Digitally fluent learners focus on understanding, constructing knowledge using discovery methods, and active engagement and these digital natives want tailored and option rich learning; and view the teacher as expert and mentor. In short, they thrive best in a student-centered learning environment. As Maryellen Weimer, a highly acclaimed authority on effective teaching, has described, there are five key changes to practice to create a student-centered learning environment [20]:

- *Balance of Power* – this represents a shift from the traditional authoritarian view of education to one that is more democratic, egalitarian, and open to a diversity of learning. In short, it moves from a "one size" to an "on demand" form of learning.
- *Function of Content* – rather than the content serving as an *ends* to be memorized and otherwise digested, content is the *means* by which students collectively and individually construct knowledge.
- *Role of the Teacher* – since the goal of teaching is to facilitate learning, teachers no longer serve as the exclusive content expert or as the authoritarian; instead, teachers lecture less and support more as the "guide on the side" as opposed to the "sage on the stage."
- *Responsibility of Learning* – student learning will shift from being extrinsically- to intrinsically-motivated using a developmental process that might include self-determination theory [21].
- *Evaluation* – both formative and summative assessment of learning from the teacher, peers, and self will be used for feedback in continuous improvement and also to measure proficiency.

5.   Teaching Digital Natives

Using our understanding of digital natives and the digital brain, we can apply Weimer's concepts of the learner-centered teaching to MET. In general, digital natives seek a constructivist learning paradigm [18] and seek active engagement, experiential learning, interactivity, and collaboration. Many of these are out of alignment with the traditional teaching paradigm. Instead, students become active participants in the construction of knowledge and seek to create that learning collaboratively while being immersed in a digital environment. In general, the following table of techniques and strategies indicates some potential means by which to satisfy Millenial student preferences.
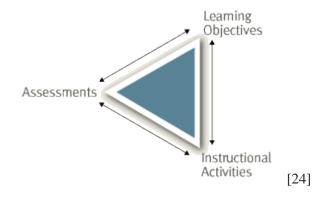
Figure 1: How different learning techniques and strategies
satisfy specific preferences of digital natives

Techniques and Strategies	Constructive	Experiential	Collaborative	Interactive
Problem-based learning [22]	■	■	■	□
Team-based learning [23]	■	▨	■	□
Simulations	□	■	▨	■
Online resources (e.g., web sites, databases)	■	□	□	■
Videos (e.g., content, tutorials)	□	□	□	■
Blogs, wikis, discussion boards, IM	▨	□	■	■
Webinars, teleconferencing	▨	▨	■	■
Course management system	□	□	□	■
Wired classroom	▨	□	■	■

It should be noted that there is no one technique or strategy that satisfies all of the preferences of the digital natives. As a result, this leads us toward a hybrid learning environment where at least a portion of the learning takes place online and involves several of the above learning techniques and strategies.

Therefore, to adapt our MET courses and teaching, we must employ an instructional design frame and evaluate how the identified *learning activities* will help students fulfil the intended *learning outcomes* as measured by appropriate *learning assessment* – all while keeping the digital natives' digital brains in mind.

Figure 2: Relationship between Learning objectives,
learning activities, and learning assessments

[24]

To facilitate how MET courses and teaching must be adapted to the digital brains of the Millennial generations, the following preliminary questions are offered:

- What are your students' preferences for learning?
- For the specified learning outcomes, how might you accommodate those preferences?
- How might you adapt your course in cases where there are multiple preferences?
- Which learning techniques and strategies (including those that involve digital media) are most appropriate for students to achieve the learning outcomes, given the preferences?
- What are the best methods and technologies for engaging your students in learning?
- Given the digital brain, how might you create scaffolding for deep learning?

- How might you strike a balance between the traditional classroom and the digital world?
- How might we assess student learning most effectively?

6.   Conclusion

There is no doubt that the digital brains of the Millennial generations demand a fundamentally different approach to teaching and learning. Our challenge will be in which ways we will change to accommodate t demands. At the same time, we cannot abandon our desire to instill deep learning (and the resulting critical thinking, reasoning, and reflection) that often results from the sustained focus and attention required by book-reading even though the digital brain is not effective in this mode. Rather, we must consider ways in which we can capitalize on the assets of the digital brain while finding practical measures to enable the deep learning.

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