Behind the Screens:

Developing a Digital Learning Literacy

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Abstract

Lifelong learning, the goal of higher education and the foundation of a free society is inaccessible to many individuals around the world because they lack the literacy skills necessary to leverage the numerous resources available through digital learning technologies. Online learning experiences require individuals to have some level of learning fluency in order to maximize the opportunity. Lack of this has caused the explosion of information online to become more of a barrier than a bridge to the development of literacy skills among those who need them most. A solution to this problem would be to shift the focus of formal education onto the development of student learning fluency. Scaffolded development of digital learning literacies would empower students to maximize their online learning opportunities and develop the ability to continue learning on their own. Teaching students to fluently relate to information, technology, other people, themselves, and the learning process empowers them to transform any kind of external circumstance into a positive learning experience. Educators that aspire to this end must understand that technology is not a deuce-ex-machina that solves every problem it encounters. Rather, student success in the online learning environment is all about what goes on behind the screens.

Keywords: literacy, technology, lifelong learning, higher education, education reform, information technology, education, internet, constructivism, self-directed learning, scaffolding, online learning, information, technology, interpersonal, intrapersonal, academic, learning fluency, accessibility, curriculum development

Behind the Screens: Developing a Digital Learning Literacy

With the advent of the Internet and modern software, access to information and learning opportunities have exploded around the globe. However, the results of this overwhelming flood of information have left researchers wondering whether it really provides a solution to the problem of illiteracy. This synthesis explores the problems of online learning and proposes a solution: the development of a digital learning literacy.

Some have looked at technology as a deuce-ex-machina solution to problems of illiteracy, but studies show that its tendency is to accentuate the disparity that already exists between educated and uneducated individuals. Technology access, difficulties in learning the technology, and problems with the reliability and manageability of information have transformed learning technology from a bridge to a better future into a wall that jealously guards access to lifelong learning from many of the individuals who need it most. Increasing the amount and diversity of information an individual can access is helpful, but only when it is accompanied by knowledge of how to do something useful with that information.

Individuals require a unique form of digital learning literacy in order to succeed as students in an online environment. Research suggests five categories of learning fluencies that could be used to train students in digital learning literacy. Information fluency involves training students to relate to information resources effectively and is sometimes thought of as basic literacy. Technology fluency has evolved as a distinct field from information literacy that focuses on the unique skills required for students to develop the various learning fluencies in a digital

environment. Interpersonal fluency describes the student's ability to navigate relationships and communication as foundational to success in learning. Intrapersonal fluency revolves around cognitive, emotional, physical, and spiritual development of the student as the framework for the learning experience. Finally, academic fluency applies all other learning fluencies toward the evolution of a self-motivated, self-guided, self-assessed, lifelong learning experience.

Equipping students with such competencies has been shown to make them more effective learners and researchers have used this to argue for a stronger emphasis on developing these skills through the formal education process. Most commonly, teachers are encouraged to incorporate these fluencies into the regular classroom instruction, but some have begun to suggest that the entire learning experience needs to revolve around developing these fluencies. They are essential to the creation of lifelong learners and should be at the center and not the periphery of the student educational experience.

Learning technologies on their own may not provide a solution to the problem of illiteracy, but when paired with the development of a digital learning literacy they show great potential. After all, education is not just about words showing up on the screens of connected individuals around the world, its about what the individual students have learned to do with them by developing learning fluency behind the screens.

Lifelong Learning and Technology

Importance of Lifelong Learning

In the information age where knowledge is constantly updated, the ability to continuously learn is vital to individuals, business, and citizenship (ACRL, 1989; Candy, 2002). To be effective, lifelong learning must become more than just a passive process of consuming information, knowledge, or experiences. "In times of rapid and pervasive change, an existing or static body of knowledge does not equip people with the ability to cope, much less to thrive and advance" (Candy, 2002, p. 3). Rather, the knowledge base of an individual must be under constant development in an ever-changing environment. Recognizing the need to equip individuals to survive in this dynamic environment the ALA has stated, "Developing lifelong learners is central to the mission of higher education institutions" (2000).

Learning and Literacy

According to UNESCO (2006), literacy and lifelong learning are interconnected: "Literate societies enable the free exchange of text-based information and provide an array of opportunities for lifelong learning" (p. 159). A report by Young, Macrae, Cairns, and Pia (no date) supported this claim by demonstrating the benefits of literacy education for social justice, health, economic development and lifelong learning. Probert added that schools that want to prepare students for lifelong learning must have a strong focus on developing student proficiency with information literacy skills (2009).

The most commonly used definition of information literacy was presented by the Association of College and Research Libraries in 1989: "To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." Where individuals have mastered these skills, they can enjoy a "dynamic community…that exchanges ideas and engages in debate" (UNESCO, 2014). On the other hand, UNESCO continued, "Illiteracy…is an obstacle to a better quality of life, and can even breed exclusion and violence." Clearly, strong literacy training that equips adults for effective life-long learning can have a wide-reaching impact.

The Achievement Gap

Unfortunately, for many individuals, a solution to illiteracy has been impossible to find. Literacy, even in its early days was a tool that separated people into different categories of learning: those who could use the tools and those who had to rely on their own methods (Candy, 2002). In recent decades the gap in literacy access has continued to grow – including in the United States. "The evidence suggests" said Candy, "that those people (and peoples) who fail to keep up with developments are likely to fall progressively further and further behind…" (2002, p. 4). Instead of serving as a bridge to a new life, for many people literacy has become a blockade preventing access to engagement in economic, civic, and social functions.

One example of the increasing gap in access comes from data published by the Higher Education Research Institute in 2015. Analysis shows that the number of students enrolled in higher education in the United States increased between 1980 and 2013. The percentage of A students increased from 26% to 52% of this number

while the percentage of C students declined from 15% to 3% during the same period. Meanwhile, the number of students who identified higher education as a means to financial stability increased from 62% to 82% over the same time period. This data confirms the increasing impact that a student's ability to learn has upon his or her potential to earn a reasonable living. College marketing programs proudly display statistics about the difference in lifetime earnings by individuals with a college degree versus those without. Sadly, this only accentuates the fact that students in the United States who fall behind in high-school are at a greater risk of losing the opportunity for higher education and economic success than their parents only 2 decades previous.

The Golden Hand of Technology

Many individuals have begun looking toward learning technology as the answer to this problem of accessibility. Candy (2002) identified the impact of technology on learning through, globalization, automatization, work requirements, family and community relationships, and the explosion of information. Much of this information has been curated by individuals and organizations offering informal learning experiences through Massive Open Online Courses (MOOCs). One of these, Connexxions Academy, was founded by Richard Baraniuk who delivered an address in 2006 celebrating the way in which online information helped to remove the barriers students faced to accessing information. With access to the internet, all the knowledge of the world is at the fingertips of any individual. Furthermore, Ghaffari identified this digitalization of information as helping students to focus on learning and participation rather than on searching for information (2008).

Students themselves have gravitated toward online learning opportunities in search of accessibility (Agarwal, 2013). For some, accessibility means that the learning opportunity fits with their lifestyle, unlike local schools that require specific meeting times and locations (Ghaffari, 2008). Others appreciate the self-paced nature of many courses (Agarwal, 2013; ALA, 2000; Codreanu & Vasliescu, 2013). For others still, the financial price of online learning is more accessible than other learning opportunities. In the case of YouTube and other video lecture series, it might even be free. Although their focus is on accessibility, many of these students would be glad to know that online lectures are a good substitute for face-to-face lectures, according to a study by Wieling and Hoffman (2010).

Besides accessibility, students give a variety of other reasons for choosing online educational options. Personalized, instant feedback is important to many students (Agarwal, 2013; Koller, 2012). However, Wieling and Hofman (2010) could not find any significant correlation between instant automated feedback and student performance. Peer support and interaction (Agarwal, 2013; Codreanu & Vasilescu, 2013) are other valuable aspects of the online learning experience and blend together with the idea of instant feedback to spur the recent development of gamified learning experiences.

Howard Gardner's theory of Multiple Intelligences may explain some of student interest in online learning opportunities. The greater range of teaching styles and learning experiences available online naturally appeals to a wider diversity of learning styles (Codreanu & Vasilescu, 2013). A study by Bhatti and Bart (2013) showed a significant relationship between learning styles and academic

achievement. This is similar to an observation by Dewey (1938) that "those to whom the provided conditions were suitable managed to learn" (p. 53). If one free online lecture is not a suitable condition, it is very easy for students to find a more relevant teacher somewhere else online.

Problems in online learning.

The preceding examples demonstrate that technology has revolutionized the learning experience in terms of access to information and opportunities to learn. Individuals who have the right background may be able to maximize the experience of online learning. On the other hand, it is impossible to say "go": and expect an inexperienced swimmer to figure out how to win a race. They will be too busy trying not to drown to achieve a goal.

Similarly, Kirschner, Sweller, & Clark (2006) have observed that students need guidance if they are going to do anything useful with the opportunities presented to them by online learning. Accessibility issues run much deeper than access to a computer and the Internet, information and knowledge are not the same thing as education, and most online learning experiences rarely transcend the lower levels of Bloom's Taxonomy. Mere access to the rapidly expanding amount of information online does not guarantee that an individual will have a helpful learning experience. There must be some guiding metanarrative to the individual's encounter with online learning opportunities.

John Dewey in Experience and Education (1938) defined a positive constructivist learning experience as one that gradually builds on itself over time.

Most online learning does not meet this criteria. Only a small percentage takes place in a formal environment (Merriam and Bierema, 2014), and this has led to a fragmented experience for many students. For these reason and others, Young, Macrae, Cairns, and Pia (no date) have questioned whether e-learning holds the potential to include a greater number of individuals in education.

Technology Access

For many students around the world the most basic issue facing their access to learning is the lack of technology. For nearly a decade, education researcher Sugata Mitra conducted "Hole in the Wall" experiments. These involved placing one computer in an impoverished location in India and watching to see what happened over time. The results of this study showed that children were able to share their resources and develop their own opportunities for learning outside of a formal educational context (E. G. West Centre, 2015). Thus, a formal educational context is not necessarily a requirement for learning with technology. However, the experiment was conducted with children and may be more difficult to duplicate with adult learners.

Unfortunately, access to technology is not the only problem for many individuals in developing countries. Those who do have the technology available may not know how to use it or find it to function poorly. Al-Suqri's study of university students in Oman (2007) showed limited accessibility of full-text resources, poor Internet connection if it was available, and relatively few sources in Arabic. But even in developed countries, training is not always available, as demonstrated by a survey of nursing students in the UK in 2004 (Kaminsky, Switzer,

& Gloeckner, 2009). Though the situation has obviously changed since then, a study by Healey (2015) reiterated that access to technology resources is still limited.

Another issue of access was discovered in the poor areas of Scotland by Young, Macrae, Cairns, and Pia (no date). Their investigation showed that even when offered access to literacy education, individuals who need it do not necessarily have a value for it and either avoid it altogether or drop out before making progress. Cieslik and Simpson also recognize that opportunity does not necessarily mean people who need help will take it (2006). A study by Heath and Miller (2012) showed that perceptions of the benefits of online learning can vary based on culture, environment, and age. Not everyone is looking for the same thing. Furthermore, by the time late individuals arrive on the scene eager to participate in online learning, there are already hierarchies and power structures in place that may be difficult, if not impossible for them to navigate (Charlton, no date). For this reason, Mitra (2007) has recommended that technology be introduced in advance of the ideology surrounding its use so that it can develop naturally rather than along predefined pathways.

Despite the growth in access to learning experiences through technology (Agarwal, 2013), it remains to be seen whether this can be used to develop information literacy instead of becoming yet another barrier to learning for those who need it the most. According to the ACRL (1989), those who most need the information are least likely to have the resources to access it. Even though a growing number of individuals have received access to technology, and now information, the OECD has recognized that this access must be complemented by certain technical

skills if students are to be able to use the information that becomes accessible (Virkus, 2003). Without these skills, the sheer volume of information may only serve to make literacy access more complicated and confusing.

Technology Use

A study cited by Merriam and Bierema showed that "[students feel] overwhelmed and excluded...in a Higher Education culture-a culture that speaks a 'foreign language,' which follows procedures that are unfamiliar and not understood (Smears, p. 108)" (p.129). It is in the middle of this bewildering context that students are expected to acquire fluency in information literacy and technology (Candy, 2002). "Most online settings are characterized by minimal guidance, which require learners to be more autonomous and self-directed..." (Rienties, B., Giesbers, B., Tempelaar, D., Lygo-Baker, S., Segers, M., & Gijselaers, W., 2012). This has the tendency to accentuate the difference between learners who are fluent with technology and those who are not.

In the regular classroom, learners that have issues with developing the necessary literacy skills are often left behind by their teachers, said DeValenzuela (2001). Individuals with cognitive impairments are treated as having no potential for development. The same thing occurs with students who do not have the technical skills to keep up with the online learning experience, but their absence is less visible. Thus, Mokhtar, Majid, & Foo cited studies to show that "furnishing schools with advanced technology does not necessarily mean the students and teachers are sufficiently information literate to use those tools effectively (Grafstein, 2007 and Usluel, 2007)." This becomes a glaring problem when a study by Holder,

Jones, Robinson, and Krass (2006) has showed that the level of student literacy could be used as an effective predictor of academic performance in a university degree program.

Surprisingly, Probert (2009) found that very few teachers know how to develop their students skills in information literacy, and Candy (2002) found that those who do offer information literacy training seldom go beyond teaching basic reading or technology user skills. To counteract the lack of training, Morgan (2010) tried to link classroom education methods with online experiences that students may already be familiar with. A similar thought by the University of Chester Business School led to the discovery that even a distraction like Facebook can be used as a learning tool (Page and Webb, 2013). However, as the learning communication modality transitions from written to visual communication (Charlton, no date), such training may become more difficult. As the ASI (2015) reported, technology now outpaces learning skills making it nearly impossible for teachers or students to depend on certain types of fluency.

Information Problems

A third problem with online learning is that more information does not necessarily translate into ability to use information (ALA, 2000). Much of the information created and shared online comes to individuals through multiple "unfiltered" channels (ALA, 2000; Candy, 2002). In 1989 the ACRL noted: "in an attempt to reduce information to easily manageable segments, most people have become dependent on others for their information" (ACRL, 1989). In the same year

that statement was published, the Internet was born leading to an exponential increase in the amount of information available with questionable reliability.

This may be part of what prompted the OECD to emphasize the importance of skills in "accessing, handling and using data" rather than just remembering information from certain fields of knowledge (Virkus, 2003). Mokhtar, Majid, and Foo (2008) supported this conclusion by saying,

> The information explosion has created the need for more guidance in the evaluation, selection, and use of information (Foo, Chaudhry, Majid, & Logan, 2002). Thus, even with the widespread availability of the Internet, students still need guidance and coaching on how to use online information effectively (Halttunen & Jarvelin, 2005).

One example of this is the need for students to recognize the economic, legal, and social issues surrounding their use of information (ALA, 2000).

Unfortunately, the legal framework for information management has not kept pace with developments in technology and information use. Baraniuk in his 2006 presentation noted that contemporary models of collaborative development and sharing are actually not allowed under the current legal framework for information ownership. This empowers the scenario in which information technology creates an "increasingly fragmented information base…components of which are only available to people with money and/or acceptable institutional affiliation" (ACRL, 1989). Baraniuk, however looks optimistically to the development of fair use as a potential solution to this barrier of accessibility.

Information is Not Education

If students are able to make it past the hurdles of accessibility, technology use, and information problems, they effectively discover that information does not equal education. In the days before Google, the two were more closely aligned. However, Ghaffari (2008) said, "The information age has changed the role of educators from one of disseminators of facts and theories to one of facilitators who assist students to become lifelong learners." A similar argument could be made for learning platforms. Their value does not consist of their ability to distribute information, but to provide a learning experience that reproduces on-campus results (ALA, 2000).

In order to accomplish this, many colleges have attempted to replicate the offline learning experience in an online environment (Codreanu & Vasilescu, 2013). "Education really hasn't changed in the past 500 years," said Agarwal (2013), but now Codreanu and Vasilescu (2013) have suggested that the e-learning environment challenges the traditional practice of teaching and learning as conducted in an offline environment. Zucca (2013) echoed this sentiment by criticizing the attempt of universities to recreate the classroom experience online. As an alternative, Zucca argued that working adults need a unique online learning experience.

This recommendation is in line with a report by Steffens (2015) who presented an article arguing that the purpose of learning is far deeper than simply knowing. To support this argument, he cited the European Commission, which said, "...Learning to know encompasses more than acquiring knowledge, it also includes

the desire to know, a positive attitude towards learning and learning to learn" (p. 54). Parents, educators, and business leaders all want better "thinkers, problem solvers, and inquirers," said the ACRL (1989). An online learning environment that is built around distributing information will not produce these kinds of results. It can produce workers with knowledge and technical skills, but in the workplace these only account for 25% of success (Shawn Achor as cited in Barker, 2014).

It is obvious from these difficulties of accessibility, technology, information, and education that technology is not necessarily the solution to the problem of lifelong learning and literacy development. According to Healey (2015), "Technology does not create good rubrics; a knowledgeable teacher creates good rubrics" (p. 57). Similarly, technology does not create a good student; a good student makes good use of technology. According to Schocken, in an online environment "educators don't necessarily have to teach. Instead, they can provide an environment and resources that tease out your natural ability to learn on your own. Self-study, self-exploration, self-empowerment: these are the virtues of a great education" (2012). Regrettably, students can only take advantage of this great education if they already have some skill in literacy – particularly in digital learning literacy.

Digital Learning Literacy: A Possible Solution

Digital Learning Literacy can be Taught

According to Harvard Psychologist Shawn Achor, "Most people accept that they're just born some way and that's how they're going to be the rest of their life,

and whatever they were last year is what they're going to be this year. I think positive psychology shows us that that doesn't actually have to be the case" (as cited in Barker, 2014). However, early external factors like the accessibility of learning experiences can influence future attitudes and academic performance of students (Cieslik & Simpson, 2006). As noted previously, students who struggle with literacy in the early stages of their education generally tend to fall further and further behind.

Unfortunately, the structure of education is such that students who fall behind are not given the opportunity to improve their skills. Cieslik and Simpson (2006) provide an example of a dyslexic learner who was excluded from learning opportunities because of conditions outside of her control. In order to succeed, she needed personalized training to overcome her barrier to learning. Similarly, every student brings individual obstacles to the learning environment. With support and training, they can overcome these. However, they must first experience a mindset shift.

Carol Dweck of Stanford University has said,

 In a fixed mindset students believe their basic abilities, their intelligence, their talents, are just fixed traits. They have a certain amount and that's that, and then their goal becomes to look smart all the time and never look dumb. In a growth mindset students understand that their talents and abilities can be developed through effort, good teaching and persistence. They don't necessarily think

everyone's the same or anyone can be Einstein, but they believe

everyone can get smarter if they work at it. (as cited in Clear, 2015)

Student abilities to learn in an online environment are not fixed, they just

have different starting points and strengths. Online learning partially caters to this

with its variety of learning opportunities and teaching styles. Student skill levels

may limit access to these opportunities but "…skill is something you can cultivate,

not merely something you're born with" (Clear, 2015). Supporting this idea from a

cognitive perspective, Mokhtar, Majid, and Foo (2008) cited Feuerstein's postulation

"that intelligence is dynamic and variable, not static or fixed from birth […]

intelligence can be modified through a mediator if given the right stimulation and

environment (Feuerstein, 1980)." They also pointed to an improvement in test

scores when exposed to pedagogy that catered to Gardner's multiple intelligences.

Finally, Murray (2000) showed that high achieving students demonstrate

high levels of self-regulation. However, low-achieving students when properly

motivated show an increase in self-regulation. This indicated that internal factors

like self-regulation can be trained. In an online learning environment that depends

heavily on such skills, this is good news. It is possible to teach students how to

maximize the opportunities to learn that come with access to digital technology and

the results of doing so have been very positive.

Results of Training

Self-directed and constructive learning theories advocate for the process of

learning by discovery, but studies have shown that this kind of learning is only

successful when students have previous experience or information to build on

(Kirschner et al., 2006). Similar observations by Rienties et al. (2012) showed that certain students perform well in a less structured environment (e.g. online) while others had greater difficulty. When the structure was increased in their experimental study, the first group of students began to disengage from the learning experience. However, the second group finally had the support they needed to learn from the experience.

A similar example by the ACRL (1989) described a public library in which individuals can access a wide variety of information. Students who are familiar with the process of research would not enjoy the supervision of a librarian. It would restrict their experience. However, new researchers would welcome such personalized guidance until they had developed their own internal abilities. The role of the public library, according to the ACRL is not just to provide information, but also to provide people "with the knowledge necessary to make meaningful use of existing resources" (1989).

Some teachers have applied this idea to their classrooms creating a blend of online and in-person learning experiences called a "flipped classroom." Research has demonstrated this kind of learning experience produces better results than either online or classroom-only learning models. An example of a flipped classroom is one in which information is accessed and practiced online then applied in the classroom with guidance, interaction, and access to resources. In one test comparing flipped classrooms to general classrooms, failure rates in a particular class fell from 40% to 9% (Agarwal, 2013). For this reason, Agarwal first suggested transitioning

learning entirely online, but then could only demonstrate the benefits of blended instruction to support the suggestion.

Another study by Codreanu and Vasilescu (2013) concluded that adult learners needed previous training in order to effectively maximize the online learning environment. However, they also suggested that the learners be given more opportunity to personalize the experience. Like the observations of Cieslik and Simpson (2006), they recognized that every student has a different obstacle to overcome in order to effectively utilize technology for lifelong learning.

Digital Literacy

As the picture has unfolded so far, lifelong learning has been shown to be heavily influenced by an individual's fluency with information literacy skills. "Information literacy and lifelong learning are inextricably intertwined," said Candy (2002, p. 6). The age of the Internet has made information more widely accessible, but not necessarily the literacy skills to make good use of it. Online education has not successfully transitioned beyond a platform for the presentation of information and so requires that students bring a certain amount of technological and information literacy to the learning experience. It is possible to train students to develop the literacy skills they need to maximize the online learning experience. However, these skills have not been clearly defined.

In 1989, the ACRL pointed out that there were so many different kinds of literacy that the former definition of knowing how to read must be expanded. Since then, developments in technology have forced the definition of literacy to expand far beyond simply knowing how to read. Some have grouped all the various literacy

types (cultural, information, technology, media, etc.) under "information literacy,"
but many others have created separate categories for both information literacy and
the various other kinds. The International Panel on ICT Literacy that convened in
the United States defined ICT (Information and Communication Technologies)
literacy as, "using digital technology, communications tools and/or networks to
access, manage, integrate, evaluate, and create information in order to function in a
knowledge society" (ICT Literacy Panel, 2002, p. 2 as cited in Candy, 2002). While
this and other definitions like it describe the results of literacy, there are fewer
studies that identify the process of developing literacy.

  According to Clear (2015), identity-based habit development has more
potential for long-term transformation than results-based methods. Education is a
results-based environment, but it can be overcome by the development of internal
factors. As seen previously, if students are going to be empowered to learn online,
they need to begin with internal change by challenging their mindsets.

  Simon Schocken has said that students also need a set of tools they can
experiment with in the online learning environment (2012). These tools, according
to Nazari and Webber cannot be properly defined in the online environments where
the complex and evolving environment will not conform to generic models (2012).
Instead, they argued for teaching the students how to develop their own set of
literacy skills that will meet their particular needs as individual learners.

  Kirschner (1999) created a list of some competencies that students
may choose from. These include:

...the ability to operate in ill-defined and ever-changing environments, to deal with non-routine and abstract work processes, to handle decisions and responsibilities, to work in groups, to understand dynamic systems, and to operate within expanding geographical and time horizons. In other words, competencies are a combination of complex cognitive skills (that encompass problem solving, qualitative reasoning, and higher-order skills such as self-regulation and learning-to-learn), highly integrated knowledge structures (e.g., mental models), interpersonal skills and social abilities, and attitudes and values. In addition, competencies assume the ability to flexibly coordinate these different aspects of competent behavior. (as cited in Virkus, 2003)

The skills listed here and others besides them can be divided into five basic categories of fluency that the literature identifies as necessary to student success in life-long learning.

These categories are information fluency, technology fluency, interpersonal fluency, intrapersonal fluency, and academic fluency. Unsurprisingly, their application to the online learning environment is matched by their ability to empower students to learn in any environment. As demonstrated earlier, it is not the environment that determines the student's ability to engage. It is the student that determines the value of the environment to create a positive learning experience. A study published by Rienties et al. (2012) concluded that students needed some level of training in online learning at the beginning of the experience,

but that it could be gradually removed over time to allow more autonomy in learning. As time progresses, the learner should be able to function in increasingly diverse and unstable environments both online and off. This kind of digital learning literacy can be developed by teaching students to master the five learning fluencies.

<div align="center">**Learning Fluencies**</div>

Information Fluency

Information literacy and information fluency are terms used interchangeably throughout the literature and often substituted with other terms. Occasionally researchers will use the term information fluency, or IL (Information Literacy), to refer to all five of the learning fluencies identified here. However, most often information fluency refers to the 1989 definition of information literacy by the ALA: Recognize a need for information, identify what information is needed, find and evaluate information, and apply it to some purpose (ACRL, 1989; ALA, 2000). Webber and Johnson expand on this by defining literacy as,

> effective information seeking; informed choice of information sources; information evaluation and selection; comfort in using a range of media to best advantage; awareness of issues to do with bias and reliability of information; and effectiveness in transmitting information to others. (Candy, 2002, pp. 6-7)

This last definition transcends the limitations of information fluency to touch on aspects of interpersonal and academic fluency demonstrating that none of the categories are mutually exclusive. Aspects of each one are interrelated with aspects

of the others. However, in general digital learning literacy skills tend to fall mostly

into one of the five categories identified here. Information fluency deals with the

student's relationship to information and data in contrast with technology, other

people, themselves, and the learning process.

In addition to the descriptions given above, information literacy research

tends to include skills clustered around the observation (Merriam & Bierema, 2014)

and organization (ACRL, 1989; ALA, 2000; Huvila, 2011; Al-Suqri, 2007) of

information.

The usefulness of observation is made clear by an example from the ACRL

that showed how a company saved itself from a lawsuit by finding information

about relevant patents on its product. Another example occurs frequently when

organizations spend months or even years searching for a solution to a problem that

had been previously solved. Sadly, much time and money is wasted because "many

companies do not know how to find and use such information effectively" (ACRL,

1989).

Information fluency also includes such basic literacy skills as reading ability

(ASI, 2005), research skills (Candy, 2002), finding resources (Candy, 2002),

knowledge and skill in accessing information (ALA, 2000; ACRL, 1989), and

screening this information for reliability (ALA, 2000; ACRL, 1989). Screening

depends heavily on critical thinking skills, an aspect of organizing information and is

vital to the self-governance of a people (ACRL, 1989). In a democracy, the process of

finding reliable information cannot be outsourced.

Critical thinking may be the most significant aspect of information literacy as its significance is emphasized by multiple studies (ALA, 2000; Hsiao, Chen, & Hu, 2013; Kaminsky et al., 2009; Mokhtar, Majid, & Foo, 2008; Sousa, 2011). Critical thinkers ask questions like: How do you know that?" and "What evidence do you have for that?" "Who says?" and "How can we find out?" (ACRL, 1989). Hsiao, Chen, and Hu (2013) have integrated critical thinking with technology fluency by proposing that critical thinking and problem solving should be used as grading factors in online discussion.

Two other aspects of information fluency identified by the landmark 1989 study by the Association of College and Research Librarians include the ability to manage large amounts of information effectively, and to integrate information. Other authors place higher levels of Bloom's Taxonomy of learning like the application (ACRL, 1989; ALA, 2000; Candy, 2002; Sousa, 2011), synthesis (Baraniuk, 2006; Kaminsky et al., 2009), and creation (Huvila, 2011; Probert, 2009; Sousa, 2011) of information in their definitions of information fluency. These are the ultimate goal of academic fluency and are explored further under that category.

Literacy in general, but particularly information literacy has been linked by many studies to improvements in academic performance (Mokhtar, Majid, & Foo, 2008). Other factors like knowledge acquisition and application as well as cognitive complexity are identified by Kuh, Kinzie, Buckley, Bridges, and Hayek (2006) as having an impact on student performance after college. As seen earlier, lifelong learning and literacy skills are closely related, so education on any aspect of literacy development should demonstrate these kinds of results.

Technology Fluency

Technology fluency is so foundational to ongoing student success that some universities have begun to require proficiency in information technology skills for graduation (Kaminsky, et al., 2009). Technology is the crossroad where the other five fluencies meet and find their functionality impaired or empowered. Thus, the International Standards for Technology in Education have suggested that teachers "encourage leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others" (as cited in Healey, 2015, p. 55). It will impact every other aspect of learning fluency.

Regrettably, the research discussed earlier demonstrates the impossibility of limiting the definition of technology fluency to one particular skill set. Nearly every field of study has its own unique requirements for technological mastery and function within the learning process. However there are some basic processes that apply in a majority of situations. For example, the use of library databases as part of information fluency or communication platforms as part of interpersonal fluency. In these examples technology is positioned as an addition to the other fluencies. However, it is often very difficult to transfer skills from the offline world online (Candy, p. 8). This may be part of the reason why information literacy and technology literacy are usually treated separately in research reports like Mokhtar, Majid, and Foo's 2007 study on the integration of IT into Singapore schools.

The integration of information technology into the learning process consists of two distinct processes. Part one is all about learning how to use the technology. It

includes basic IT, computer use, file management, word processing, spreadsheets, databases, presentations, information, and communication (Candy, 2002). According to Oliver and Towers (2000), the aspect of learning how to use technology is a necessary skill in itself (as cited in Candy, 2002). Healey (2015) built on this idea by identifying the transfer of this ability to multiple platforms as another significant step toward technology fluency.

The second part of technology fluency deals with applying skills of technology use to the learning process. The ALA (2000) has cited a 1999 report from the National Research Council, which underscored the difference between knowing how to use technology, and how to apply that knowledge toward some educational purpose. Kaminsky et al. (2009) highlighted this same contrast in their study on student fluency with information technology. On the one hand, it is assumed that students know more than faculty about technology. On the other hand, it is assumed that faculty don't have time to teach basic information skills. A marriage of these two problematic assumptions leads to both unprepared students and to faculty who expect higher levels of technical performance.

However, just because a student can use technology doesn't mean he or she can use that technology to make a positive impact on the learning experience. A study by Akhter (2013) demonstrated that it's not just enough to know how to use the internet. In fact, there is a negative correlation between excessive Internet use and academic performance. Other aspects of technology fluency like sociability, utility (ability to function with a given tool), and reciprocity (need for engagement) all effect the user's ability to maximize online learning (Codreanu & Vasilescu,

2013). Thus, Kuh, Kinzie, Buckley, Bridges and Hayek (2006) have warned that it is important to gauge learner readiness to benefit from engagement in technology intense learning experiences.

As with all five of the learning fluencies, educators should never assume that their students have a certain level of proficiency. They should not only provide opportunities to learn the skills, but should also stretch students' technological abilities by requiring students to use them regularly (Virkus, 2003). Online learning experiences that require some level of technical fluency may become more effective by offering training in this particular skill.

Interpersonal Fluency

Interpersonal fluency deals with relationships between individuals and can be an important predictor of academic achievement (Barker, 2014). The "Hole in the Wall" experiment by Sugata Mitra showed that children could learn how to use technology with no instruction. However, they could do this only in the context of relationships with others. A study by Andretta (2007) supported this significant role of interpersonal fluency by showing how the relational aspects of learning were vital to developing a practice of lifelong learning. Merriam and Bierema (2014) offered further explanation by showing how interaction between the person and the social world create a connection to emotion. This connection may be one reason why Codreanu and Vasilescu (2013) noted that the social roles of adults are a strong indicator of their motivation to learn.

Relationships are an important aspect of learning, especially when individuals encounter new cultural environments and perspectives. Building

connections between cultures may be part of Baraniuk's reference to teaching as the process of making connections between disparate ideas (2006). Not only do individuals need to understand the influence that their culture has on their learning experience (Gruber & Barron, 2011), they need to understand and navigate the various cultural differences they will encounter in their diverse social, academic, and institutional relationships (Mokhtar, Majid, and Foo, 2008; Richardson et al., 2012).

Digital communication technologies have made the importance of cultural navigation even more significant as individuals have a broader and longer-lasting reach to their communication. Email, graphics, web design, VOIP (Voice Over IP), and other avenues of digital communication have made technology use an indispensible aspect of interpersonal fluency (Candy, 2002; Charlton, no date).

Relational interaction and communication are important factors of student success as identified by ACRL (1989) and Sousa (2011). Barker (2014) offered one possible explanation for this link by showing how social connection is necessary for optimism and stress reduction. Vann (1996) applied this idea to human resource development programs adding that individuals with a strong network of relationships demonstrate greater levels of self-direction.

Finally, a report by The Boyer Commission ties multiple ideas of interpersonal fluency into a pedagogy design that engages students in "the framing of a significant question…research or creative exploration to find answers, and the communication skills to convey the results" (as cited in ALA, 2000). The purpose of

this design is to give students experience with interpersonal fluency that they can apply to learning experiences beyond the educational environment.

Intrapersonal Fluency

Transformative and humanist learning theories focus the educational experience on the development of the individual. This is a helpful idea since the mindset of individuals toward the process of learning and their own ability plays a significant role in their success at developing literacy skills and becoming life-long learners.

Erik Barker (2014) cited research by Shawn Achor that suggested,

> If we can get somebody to raise their levels of optimism or deepen their social connection or raise happiness, turns out every single business and educational outcome we know how to test for improves dramatically. If we can get somebody to raise their levels of optimism or deepen their social connection or raise happiness, turns out every single business and educational outcome we know how to test for improves dramatically.

Likewise, Kurbanoglu (2003) discovered a correlation between student self efficacy and "beliefs regarding information literacy and computers…."

Richardson et al. (2012) identified perceptions of self-efficacy as predictive of student performance. Their study identified five key measures of personality that may affect academic achievement: "conscientious, openness, agreeableness, neuroticism, extraversion…." Among these, the researchers identified conscientiousness as one of the most influential personality factors on academic

performance as measured by GPA (2012). The study confirmed previous conclusions that effort regulation was one of the strongest correlates with GPA performance and that procrastination may be the greatest negative correlate to academic achievement.

Other significant aspects of intrapersonal fluency include reflection (Andretta, 2007; Brookfield, 2013; Merriam & Bierema 2014), development of cognitive processes (Kirschner et al., 2006; Richardson et al., 2012), responsibility (ASI, 2005), purpose (ASI, 2005; Codreanu & Vasilescu, 2013), motivation (Codreanu & Vasilescu, 2013; Inan, 2013; Richardson et al., 2012), and persistence (ASI, 2005). Sousa (2011) has argued that arts should be considered a fundamental part of the learning experience because of their profound impact on emotional, mental, cultural, and physical development of the individual (p. 217). Research studies showed that meditative practice in higher education can lead to "the enhancement of cognitive and academic performance, the management of academic-related stress, and the development of the 'whole person'" (Shapiro, Brown & Astin, 2011, p. 496, as cited in Merriam & Bierema, 2014, p. 138). Finally, Villavicencio and Bernardo (2013) studied the impact of emotions on academic performance and found that joy and pride can moderate a student's self-regulating behavior and subsequently impact student's academic achievement.

Academic Fluency

The last of the five learning fluencies, academic fluency deals with the student's relationship to the learning process. It is the catalyst that moves the student from lower order to higher order thinking skills as exemplified by Bloom's

Taxonomy (ALA, 2000). It is partly influenced by Kirschner's recognition of a difference between the processes required to learn a subject and the processes required to perform within that field (as cited in Kirschner et al., 2006). Academic fluency ties all the other learning fluencies together in a process of learning how to learn.

According to the ALA (2000) and Sousa (2011), students need to learn how to direct their own process of discovery and education. Inan (2013) agreed on the basis of a study in Turkey that showed significant positive correlation with self-regulated learning strategies and higher grade point averages. Chief factors influencing student performance included motivation, planning and goal setting, and strategies for learning and assessment. Richardson et al. (2012) also observed that self-regulation was an aspect of academic performance that could be enhanced. Additionally, they said, goal setting, an aspect of self-regulation was one of the strongest correlates to GPA. It is also important to developing the habit of life-long learning (Clear, 2015). Demonstrating the significant amount of interaction among the various learning fluencies, self regulation is greatly influenced by emotions (Villavicencio & Bernardo, 2013), and relationships (Vann, 1996).

Other aspects of academic fluency include: adaptability to multiple environments (ACL, 1989), curiosity applied to some end (ACRL, 1989; Codreanu & Vasilescu, 2013), goal setting (Inan, 2013; Richardson et al., 2012), self assessment (Codreanu & Vasilescu, 2013; Inan, 2013), self-engagement (ACRL, 1989), and problem solving (ACRL, 1989; ALA, 2000; Candy, 2002; Sousa, 2011). The ACRL (1989) identifies problem solving as the driving force behind the process of

information literacy: "...information literate people know how to find, evaluate, and use information effectively to solve a particular problem or make a decision." Craik and Lockhart (1972) promoted a similar idea years earlier called active learning in which individuals increase their retention through interaction and depth of mental processing (as cited in Agarwal, 2013).

Mokhtar, Majid, and Foo (2008) created a model of developing academic fluency that ends with a process of specialization in one area after another. This development of mastery proceeds from practical, to technical, contextual, and then constructive (or creative). Creativity is a valuable skill for the lifelong learner in the 21st century according to Probert (2009) and Sousa (2011). Huvila (2011) supported this claim by decrying the focus of information literacy on finding information rather than on creating information and identifying this last process as a central aspect of information literacy. Along the same lines, Koller suggested "maybe we should spend less time at universities filling our students' minds with content by lecturing at them, and more time igniting their creativity, their imagination and their problem-solving skills by actually talking with them" (2012). Adding its voice to the call for a focus on creativity, one of the ISTE Standards draws upon Bloom's Taxonomy and Gardner's Multiple Intelligence Theory to support this emphasis (Healey, 2015). Creativity is an essential aspect of academic fluency.

Building on this, Baraniuk (2006) presented a model of learning through technology as an ongoing process of collaboration. In this process students discover ideas, break them apart, restructure them, share them, and build upon them in an ongoing evolution of ideas and information. To participate in this kind of advanced

model of learning, students must develop their academic fluency. Or perhaps the educators that are aware of the importance of this process could begin to guide students in how to participate in the conversation of learning through creativity.

Academic fluency is unique in that it highlights those skills that students need to transition from the guided experience of formal learning to the self-directed experience of life-long learning. None of the fluencies, though, can be fully developed on their own. Students do not suddenly begin to demonstrate the learning fluency required to develop a digital learning literacy. Usually they require a catalyst like a dedicated learning environment or perhaps individualized guidance from someone who is experienced with the process of learning.

Implications and Recommendations

Students Need Training

In the days when beakers and Bunsen burners were the latest classroom technology, Chemistry professors believed that their students needed instruction on how to make the most of these instruments. Today, when online platforms for communication and information distribution are the latest classroom technology, professors should not expect their students to figure things out for themselves. The internet is not as fragile as a glass beaker, but it can be just as complicated and dangerous to figure out how to use it effectively in the learning process. Lack of training in basic fluency skills like this prevents students from continuing the learning process once they leave formal education. It has also led to a college

readiness crisis identified by Kuh et al. (2006) in which many high school graduates are unprepared for success at the college level.

It is not enough to expect students to know how to learn. Kirschner et al. (2006) argued against the popular trend toward constructivist, problem-based, experiential, and inquiry-based teaching on the basis of the cognitive processes involved in learning. Students should not be placed in settings that they have no cognitive grid to explore. In fact, empirical research has shown that instructional techniques that offer minimal guidance are less effective than those "designed to support the cognitive processing necessary for learning" (p. 76). Although this runs counter to the popular trend toward independent self-directed online learning, the research supports their conclusion. Students need to learn how to learn in order to turn their use of technology into an educational experience. This is not a new argument.

In 1989, the Association of College and Research Librarians made the argument for restructuring the education experience around teaching students how to use information effectively across multiple contexts. Their report heralded that teaching students how to "gather, synthesize, analyze, interpret, and evaluate information…should be central, not peripheral…" to the learning experience (ACRL, 1989). More recently, UNESCO has embraced a mission of "training teachers to sensitize them to the importance of information and media literacy in the education process, enable them to integrate information and media literacy into their teaching and provide them with appropriate pedagogical methods and curricula" (UNESCO,

2014). In order to insure access to lifelong learning, higher education curriculum must incorporate training in learning fluency.

Redesign Formal Education

Numerous studies have indicated the need to develop this kind of student proficiency in learning, and a few have focused on the methods teacher's use to communicate these skills. However, the teachers are often limited in this exploration by the requirements of their context. Even those students that seem to be gifted academically do not necessarily receive further training in learning fluency. Kettler (2014), for example, showed that students in gifted student programs did not demonstrate higher levels of critical thinking than other students. As discussed previously, critical thinking skills are essential to the success of students, but even the program for gifted students did not specifically focus on developing this skill. Kettler recommended including specific teaching on this learning fluency for gifted students.

Usually if education programs include such teaching, it is incorporated into other instruction or else incidental training is provided at some point in time. Mokhtar, Foo, and Majid (2007) found that this was not sufficient. Students need ongoing exposure and guidance to information literacy training if they are to master such skills. Kaminsky et al. (2009) demonstrated that student's perceptions of their technological ability increased in the functions that were a regular part of their educational experience, but decreased in those that they may not have practiced with. This shows the importance of consistent practice with learning fluency if students want to develop the confidence to use it on their own. Kaminsky et al.

(2009) recommend that professors require students to expand their technology proficiency through assignments.

Yet, integrating the practice of learning fluency into the study of other subjects may not be the only way to effectively impart such skills to students. Webber and Johnston (2000) have suggested a more overt focus on learning fluency than that provided by the curriculum integration model. They suggested creating an academic discipline around the subject of learning fluencies (as cited in Virkus, 2003). In this model, students study the art of learning along with their other subjects.

Institutions that are not ready to add another discipline to their list of offerings may find a happy compromise in the suggestion of scaffolded training. Larkin (2002) proposed this kind of instruction that provides "…a supportive environment while facilitating student independence." As students begin to demonstrate mastery of the learning process, the teacher gradually provides less support. A study by Barron (2004) showed how this might be effective by observing that experienced students used a greater number of learning resources to achieve their educational goals (as cited in Kaminsky et al., 2009). As students become more experienced they depend less upon the teacher as a resource and more upon their own ability to discover and develop resources to guide and support their learning.

If given the opportunity to master the five learning fluencies in the context of in-person learner teacher relationships, the students who leave the institutions of higher education will be far better equipped to maximize the opportunities for lifelong learning available online. By the time the students graduate, they could be

functioning almost entirely on their own – able to apply their learning ability to just about any environment.

The Role of the Teacher

A change in the design of the learning experience implies a simultaneous change in the role of educators. As the availability of online resources grows, the function of the teacher has begun to shift away from "subject expert" to "learning expert." As Codreanu and Vasilescu (2013) suggested, the teacher is becoming less of a lecturer and more of a "facilitator and resource person." In a world in which the growth of information outpaces the human ability to learn, such a transition is increasingly urgent.

Several different models are available for teachers that want to attempt this transition. The first was explored by the Great Books programs for liberal arts education in the early 1900's and continues to this day in several small pockets of education (Rivendell, 2014). In this model, the teachers guide students through an encounter with information presented by the authors of the writings that influenced western civilization (Jenson, 2014). They help the students master their information skills, interpersonal skills, intrapersonal skills, and academic skills in the process. Developments in technology have added this fifth dimension to the experience of learning and have helped to streamline the process.

Another model is offered by the Swedish education system that partners with librarians to help the students develop information literacy. Norway has also begun to change the function of its library system by repositioning it as a learning center and not just an information resource (Virkus, 2003). Researchers from

Singapore have suggested a similar function for librarians that focuses specifically on helping student develop technology fluency (Mokhtar, Foo, & Majid, 2007). They recommend creating an entirely new position of teacher that focuses on training students in learning fluency.

These teachers will be supported by subject experts like Simon Schocken who "laid out everything on the Web and invited the world to come over, take whatever they need, and do whatever they want with it" (2012). His online learning experience gave students all the information and instructions to learn. Those who had the right background were able to use it effectively. Those who did not might wish that they had been given the opportunity to develop their learning fluency as defined above.

Numerous online resources for sharing information, communicating with students, and facilitating learning experiences will also support the new teacher of the 21st century. Classroom administration, social platforms, communication technologies and assessment management tools will provide in-depth interaction around student progress and help to create personalized learning plans. Driven by this vision, a team from Singularity University recently designed an assessment platform called Cookie to analyze student performance from multiple angles and offer personalized recommendations on improvement (Singularity University, 2014).

Independent of teachers and students that know how to use it effectively, such technology has limited use. However, when paired with teachers and students who understand the importance of mastering the learning process, technology like

this has the potential to surpass the performance already demonstrated by the flipped classroom. Developments like this reach toward the beginnings of a personalized, customized, and incredibly effective education experience that never ends. Instead, as students become more confident in their ability to learn, the supports of formal education are removed and they continue the process guided by their own internal ability to learn.

Future Research

Learning fluency may be the key to unlocking the potential of the information and learning opportunities available through online technology. Each one of the learning fluencies identified above has received support from numerous studies showing its impact upon student performance. Beyond the aspects of learning fluency presented here, though, there are many other factors that have been shown to influence student success. Those that were included in this study were identified as having significant impact on student literacy or performance in an online learning setting. The purpose of including them here was to provide evidence for the usefulness of the 5 categories of learning fluency. However, more research is needed to create an exhaustive list of features included in each category.

Thorough research did not uncover any experimental studies conducted to discover what kind of an impact teaching these learning fluencies as a whole set could have on student academic performance in an online environment. Perhaps this is due to the novelty of designing a curriculum around them. If such a curriculum were designed, it should be scientifically tested to discover if it had the potential to improve student performance. If a significant correlation was found

between mastery of these learning fluencies and student performance, it may pave the way for a more comprehensive model of learning and assessment that takes the whole student into account. It may also introduce a model of education that reduces the disparity in student performance rather than emphasizing it. The author is currently conducting a pilot study to discover whether student mastery of learning fluency can help to reduce the achievement gap in student performance.

Resources used for this particular synthesis were primarily focused on adult learning and higher education, but there are several indicators that it would be more valuable to teach these skills to younger students. Experiments by Sugata Mitra, whose studies were mentioned previously, show incredible promise for helping children master basic literacy and learning skills through a blend of local and internet technology (E. G. West Centre, 2015). The Montessori Method (Montessori, 2004) is still employed with preschool children around the world and continues to prepare young children for academic success. It would be incredibly helpful to discover whether learning fluency might be even more valuable to students if it is taught at a younger age.

In order to put the ideas of this study into practice, more focused research is needed to pinpoint those aspects of learning most crucial to developing the learning fluency needed for ongoing learning outside the classroom. Practical resources are needed for teachers to incorporate learning fluency into curriculum or to begin teaching it as its own discipline. Supporting research is needed to encourage administrators and policy makers to begin repositioning the education system around the development of individual life-long learners rather than the transfer of

content. Finally, online learning opportunities might make themselves more competitive and useful if they incorporate the development of learning fluency into the experience. Perhaps some could be designed entirely around helping students develop the internal skills of digital learning literacy so they can effectively use the other resources available through the internet.

Conclusion

In summary, the relationships that students have with information, technology, other people, themselves, and the process of learning should not be left to develop on their own. Whether they constitute a discipline of their own or play a greatly expanded role in the current structure of higher education, these learning fluencies need to take their place at the heart of the education experience. Without the development of this kind of digital learning literacy, students will be unable to maximize the opportunity presented by the explosion of information and learning programs available through the internet.

Although access to information is an important step to developing literacy, individuals need guidance on how to use this information to create a positive, connected educational experience. Educators can train students in the various learning fluencies as a way to develop their digital learning literacy. Information fluency, technology fluency, interpersonal fluency, intrapersonal fluency, and academic fluency can provide the foundation students need to become independent, self-directed, lifelong learners in any environment.

Until this happens, the Internet will continue to function effectively as an access point to an overwhelming repository of content and information. The technology resources proliferating throughout the online world are great tools for those who can use them effectively, but their power is only truly harnessed by those who understand that online learning begins behind the screens.

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