Becoming Relevant Again:
Applying Connectivism Learning Theory to Today's Classrooms

Jeff Utecht, Independent Scholar

Doreen Keller, Whitworth University

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Abstract

This paper will examine the eight principles of Connectivism Learning Theory and provide examples of how institutions of learning—K-12 and higher education—may think about applying them. Engaging in such work will allow institutions to take advantage of technological platforms as they exist today and into the future. While the Internet has brought with it the opportunity for a connected, collaborative learning landscape, many classrooms and academic institutions today do not take full advantage of the value this connectedness can have for their learners. Using the eight principles as a frame, this paper will offer concrete techniques for K-12 and higher education institutions to engage their learners in the collaborative learning environment of today's technologically connected landscape.

The modern Internet is now 29 years old, yet some learning institutions have been slow to embrace these new technological platforms as a place for productive public discourse to happen. Leveraging these technologies in meaningful ways to share work, add value to the conversation, and find ways to connect to community, has potential to further all participants' learning.

The two authors of the forthcoming discussion draw from expertise from their combined 24 years as K-12 educators and an additional 20 years at institutions of higher education preparing teachers. Additionally, while one author speaks and writes nationally on topics as diverse as culturally responsive teaching, place-based education, and the edTPA, the other speaks internationally on educational technology issues and works as a private consultant for over 100 K-12 school districts across 30 plus states as well as with international schools across 20 countries. The perspective in this piece, therefore, is informed by this extensive experience with educators and students across generations and throughout a variety of educational settings.

Our work and the views expressed here aim to add tools and new best practices to both the K-12 and higher education experience, particularly in the area of helping educators and academics alike leverage online platforms successfully. The power lies not in the technology platforms themselves but in the connections they foster. Educators in both K-12 and university classrooms who take risks and embrace these connected learning technologies have potential to uncover a whole new way of learning. For the purpose of this article *learning* is defined as the acquisition of skills

and knowledge through a learners' actions and personal experiences. For learning to truly occur, learners must be active in constructing new knowledge for themselves. Therefore, *learning*, as it is discussed here, is not viewed as the product of simply being taught.

George Siemens' Connectivism Learning Theory

This paper will apply George Siemens' Connectivism Learning Theory (Siemens, 2005) to a variety of educational settings and illustrate ways in which educators and academics can and have used technology platforms to share their work and engage in public conversations. George Siemens' Connectivism Learning Theory was written on his blog, elearningspaces.org, originally in 2004. Over the next year he received feedback from other academics, and in 2005 updated the theory based on feedback from others. Today this learning theory has been adopted by institutions of learning and has created the Massive Open Online Courses (MOOC) movement. Many institutions of learning that understand the changing landscape of how people learn, where they learn, and what they want to learn, have created websites like Edx, https://www.edx.org/, where anyone can take a course and/or engage in public discourse around a given topic. These MOOCs create a community of learners who continue to push the conversation forward.

Siemens' Eight Principles of the Connectivism Learning Theory:

1. Learning and knowledge rests in diversity of opinions.
2. Learning is a process of connecting specialized nodes or information sources.
3. Learning may reside in non-human appliances.
4. Capacity to know more is more critical than what is currently known.
5. Nurturing and maintaining connections is needed to facilitate continual learning.
6. Ability to see connections between fields, ideas, and concepts is a core skill.
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
8. Decision making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

This paper will examine these eight principles and provide examples of how institutions of learning can apply them. Engaging in such work can lead to limitless opportunities within classrooms and for students of all ages. For the purpose of this article what it means to be educated will be framed by George Siemens' eight principles. For example, being educated is not about simply knowing information or memorizing facts but rather about learners' ability to apply these eight principles in a connected world to create new meaning for themselves. Knowledge therefore is not a set of facts but rather a learner's ability to learn, unlearn, and relearn information quickly and be able to apply that new knowledge in an ever-changing information landscape. For the sake of this discussion, *learning* is the ability to discover something unknown. *Unlearning* involves critically analyzing and in some cases rejecting information or beliefs once held to be true in the presence of new information. Finally, *relearning* is the arriving at a new understanding, sometimes replacing perspectives that were once expected or believed from past experiences.

Principle #1: Learning and Knowledge Rests in Diversity of Opinions

The Internet allows anyone a voice and an opinion on any given topic. The power of opinion and the debating of facts and non-facts is at the crux of the issue of whether the Internet has truly had a positive impact on our society at large. If one is to believe that learning and knowledge rests in diversity of opinions, as stated by Siemens, then structures need to be put in place to allow for such debates to take place. It is these structures that are lacking in many online forums and communities. Online forums and communities need these procedures and protocols that would then allow for opinions to be shared in a common and civil atmosphere. What would follow, then, is an environment that would provide fact and opinion to be shared, extrapolated, and synthesized with the end result hopefully being learning and knowledge.

Wikipedia is one example of this principle of Connectivism at work. Wikipedia, with its 5.6 million articles created by 33.7 million users making over 840 million edits (Wikipedia: Statistics, 2018), shows the power of learning and knowledge forming from a diversity of opinions. Because there are so many users fact checking each other's work, the review practices built by the community of users themselves work to maintain the integrity of the articles that are written. The review practices and protocols of Wikipedia, though criticized for favoring rapid turnaround, are forcing educators to reconsider the value and credibility of crowdsourced digital resources (Antonio, 2014). Rather than trying to convince students not to use crowdsourced digital resources like Wikipedia, educators can come alongside students and teach them how to use and evaluate such sources properly (Murley, 2008).

Wikipedia's good article criteria and quality scale rubric ("Wikipedia: Good Article Criteria," 2019; "WikiProject Article Quality Grading Scheme," 2016) are just two protocols that are in place to ensure the rigor and reliability of information has a common standard to adhere to. Accuracy is definitely important; however, Halsted argues that academics might put too much weight on accuracy when there are other factors at play: "While Wikipedia may have demonstrable shortcomings, it also has strengths in areas such as completeness and accessibility. These strengths appear when historical narratives in Wikipedia are compared to other sources of historical information readily available to American undergraduates" (Halsted, 2013, para. 1). Learners today are not held to the information shared and synthesized in a book or chapter. Wikipedia is not limited in its depth and breadth of any given topic. Furthermore, accurate information is important, but if it is not accessible by the learner then the information does nothing to inform the learner on that given topic. The goal, along with accuracy, should be to strive to continue to make accurate and complete information *accessible* to learners. What better place to continue this endeavor than an online encyclopedia accessible to all?

As institutions embrace this new understanding of learning and knowledge residing in diversity of opinions, it opens itself up to great possibilities both in teaching and in research:

> Once the bane of teachers, Wikipedia and entry-writing exercises are becoming more common on college campuses as academia and the online site drop mutual suspicions and seek to cooperate. In at least 150 courses at colleges in the U.S. and Canada, including UC Berkeley, UC San Francisco's medical school, Boston College and Carnegie Mellon University, students were assigned to create or expand Wikipedia entries this year. (Gordon, 2014, para. 6)

To see this diversity of opinion at work one must only go so far as the talk section found in every Wikipedia article. Located in the upper left corner, the talk section of an article provides information to the community on the importance of the article, article policies, and, as the section title suggests, a place to talk, discuss, debate, and agree upon what should appear in the article itself. The procedures and protocols found in the talk section of every article provide the structure that allows the community to uphold the rigor and accuracy of the article itself. One description of the research that went into a course activity where students contributed to a section offers: "Their projects had to be researched, composed, and coded to match Wikipedia's strict protocols. Schug and her classmates wound up citing 218 scholarly legal and newspaper sources for their entry on a 1978 U.S. Supreme Court decision allowing corporate donations for ballot initiative campaigns" (Gordon, 2014, para. 3). It is within this talk section that the community's opinions are supported by evidence and lead to productive work and results. Here community members debate, discuss, and offer citations to backup and support or debunk claims made by other community members. This is also where discussion takes place regarding whether something should be removed from an article if a claim cannot be backed up by evidence, citation, or reference.

These new systems of knowledge creation can be a useful tool for educators from all spheres to embrace, and the power to use it for public discourse is tremendous. Understanding that crowd-created content is not always automatically significantly less valid than peer-reviewed information is key to a way of thinking about this content as a potential contributor to students' learning. It is significant that educators have an opportunity to teach and support learners in understanding the difference between peer-reviewed content and that which can be found on Wikipedia; critically analyzing this new crowd-created content is a crucial literacy skill. Educators who learn and grow from interactions with this platform, and then incorporate educating their own students about crowd-created platforms, will aid students in building an invaluable literacy skill. Such a shift would celebrate that learning and knowledge rest, at least in part, in diversity of opinion.

Principle #2: Learning is a Process of Connecting Specialized Nodes or Information Sources

When data is free and open, new discoveries are always just around the corner. A core literacy skill of today is the ability to connect information sources to get a new or more complete view on any given subject. This is explained best by the creator of the World Wide Web, Tim Berners-Lee, in his 2010 Ted Talk: The Year Open Data Went World Wide: "...if people put data onto the web—government data, scientific data, community data, whatever it is…it will be used by other people to do wonderful things, in ways that they never could have imagined" (Berners-Lee, 2010).

All one has to do is look at any of a host of new apps or web-based software to see this principle of the Connectivism Theory at play. The ability to connect data and information sources and make meaning from that data is what it means to learn in the information world.

One suburban school district of roughly 11,000 students in Washington State wanted to be more mindful in how to ensure voter-approved funding. To do this, they connected the information of voter data, freely released on the Internet by each county, and formatted it in Excel so that it could be uploaded to Google My Maps. Google My Maps allows a user to upload data sets that are then displayed on a map using geo-location data found in the data set. The district was interested in seeing which precincts had the highest voter turnout and the most "yes" votes for the

school district's levies. Connecting the information of voters to a map, the school district got a clear picture of where to focus their efforts in order to pass their next levy. Armed with this data, they were able to rally more yes voters in specific precincts and get their school improvement and technology levy passed.

This is just one of a host of stories that can be told when information is taken from a variety of sources and creates something new and meaningful. In educational institutions this can become a critical skill in analyzing and using the data freely available to create new and meaningful discoveries. In 2008, Don Tapscott and Anthony Williams, in their book Wikinomics, not only explain in depth how this new information economy employing open sharing changed the global landscape but also how the rise of the Internet has led to online users becoming "prosumers" (Tapscott & Williams, 2008). A prosumer, or someone who produces content while consuming at the same time, represents a key aspect of the new information age. The idea that everyone can and should use the data openly available to them to rethink ideas, create new data, and investigate findings in an open and collaborative format, has potential to contribute to and offer grounding for myriad lines of scholarship inquiry at higher education institutions. Additionally, connecting data and making meaning of the new picture that appears as a result of those connections represents another core literacy skill of the information age.

Principle #3: Learning May Reside in Non-human Appliances

In 2011 the world watched as Watson, the IBM Supercomputer, took on Ken Jennings, the winningest Jeopardy player of all time and Brad Rutter the highest earner in Jeopardy history. In the showdown for the ages, Jennings believed he would beat Watson: "I was pretty confident that I was going to win," says Jennings of how he felt going into the match. He continued:

> I had taken some Artificial Intelligence classes and I knew there were no computers that could do what you need to do to win on Jeopardy. People don't realize how tough it is to write that kind of program that can read a clue in a natural language like English—to understand the puns, the red herrings, to unpack just the meaning of the clue...I thought, "Yes I will come destroy the computer." (May, 2013, para. 5)

In every classroom of today, educators are faced with looking at the backs of devices instead of the faces of their students. With the rise of Artificial Intelligence (AI) how do educators embrace these devices entering their classrooms and learning spaces? What is the implication when students have the power to learn on their own, aided by a device with little input from the humans running them? What is the role of the instructor in teaching students how to be critical consumers of all the content they encounter?

This article was written on a Google Doc and a large part of it is not being written by a human author, per se. Within a Google Doc, writers go to Tools—Voice Typing and talk into a microphone what it is they want to write. The AI built into word processors puts sentences together, analyzes the audio, and even predicts what it hears if it was not spoken correctly. Punctuation is added by simply saying "period" and a new paragraph is started by saying "new paragraph." The more the writer uses the service, the better it becomes at learning how the author writes and predicting what it is the writer is going to say or trying to convey. This power is available to every learner at every level of schooling. AI features like these also provide immense freedom to people limited by physical challenges that make the act of writing impossible for them.

This is a simple application of what is known as machine learning. With the rise of social-media and information analytics, understanding what applications are learning from the user and for the user becomes another important core literacy skill. Once people have the data from the second principle they then can call on computers to learn and find patterns within that data to help them learn and make decisions that may lead to new discoveries. Apple's iWatch gathers and presents data to its user in real time, at the same time using that data to form an image of the person's health, and, in extreme cases has been credited for predicting heart attacks before they are felt by the person wearing the watch (Hall & Apple, 2017).

At an international school in Luxembourg they are looking at using lunch data to predict the mood and learning readiness of students based on what they have chosen to eat. The school system has implemented a tap card system for transactions. This card, tied to the student's ID number, then creates a database of the child's meal choices throughout the school year. Giving teachers access to that data and adding their own input into the system on how the student behaved and performed in the afternoon, could lead to both helping students make choices about the food they eat and help teachers modify their lessons to better meet the needs of their students.

It can be tremendously helpful for all academic institutions to understand the data available to them. The data available to students and the ways they can help each other to use that data meaningfully represents another key literacy skill. Computers are learning from its users for its users, and learning to use that information to create new outcomes can be invigorating for teachers and students alike. Deeper questioning and student engagement with non-human appliances to make sense of this rapidly changing information world is key to institutions' and students' success.

Principle #4: Capacity to Know More is More Critical than what is Currently Known

In August 2010, Eric Schmidt, CEO of Google Inc., stated, "Every two days now we create as much information as we did from the dawn of civilization up until 2003. That's something like five exabytes of data" (Siegler, 2010, para. 2). A lot of debate followed this statement on what does he mean by "create" and what is meant by "information." Is a tweet or an Instagram image considered information? A multitude of information is created on the Internet each day. The quantity of the content is increasing; however, the quality of that content must be thoughtfully filtered by its consumer. This includes taking a close look at the source as well as the protocol for publication and review of the source. Because of the rise of the prosumer, there is a rapidly growing information landscape that must continually be assessed and re-assessed. Gonzalez (2004) argues because of this new information landscape, knowledge must be measured in months, not years.

"One of the most persuasive factors is the shrinking half-life of knowledge" (Siemens, 2005, p. 3). The "half-life of knowledge" is the time span from when knowledge is gained to when it becomes obsolete. Half of what is known today was not known 10 years ago. The amount of knowledge in the world has doubled in the past 10 years and is doubling every 18 months according to the American Society of Training and Documentation (ASTD). To combat the shrinking half-life of knowledge, organizations have been forced to develop new methods of "deploying instruction."

In a knowledge economy, the capacity to learn, unlearn, and relearn quickly is another core skill. What is true today may not be true tomorrow. Furthermore, the majority of the students today have grown up within this rapidly changing information landscape and need to understand how to find and use the information they have at their fingertips. Educators in all settings will benefit from understanding that, for better or for worse, search engines such as Google and Bing have become

the default research tool for learners today. No longer are databases and library archives the places students go first to learn. When information is free, open, and available, that is where learners start and in many cases end their research. This has led to frustration within the academic world as many learners today are good at "looking stuff up" but lack the deep research skills needed to find the information and critically analyze it and its source in a rigorous way. It is not that the information is not out there, but instead, there is a lack of skill to *find* the information and validate it. Educators now have the important task of teaching students how to conduct deep research utilizing all the resources available to them. This includes exposing them to content available through library databases *and* Internet searches. It also includes teaching them to evaluate all the information they do find, be it from a peer-reviewed empirical study or a *New York Times* blog. What it looks like to conduct research has changed, and the skills associated with this practice have changed along with it. Only after students have these skills to apply to an open and overabundance of information on the Internet, can the information within truly be used to know more than what is currently known.

Teaching and understanding how to deep-search the Internet using search engines is a valuable skill for students to master. Teaching research methods such as "site:" is one way to help learners not only deep-search the Internet but get a variety of perspectives on any given topic. For example, doing a search "Vietnam War site:gov" provides the U.S. government's perspective on the Vietnam War. This is also the only perspective many U.S. students ever hear or study. However, by doing a search for "American War site:gov.vn," students are instantly taken to a different perspective of this conflict, a perspective that very few Americans have ever studied or thought about. And yet, today, these diverse perspectives are within the reach of every learner with an Internet connection. "American War site:gov.vn" provides the Vietnam government's perspective of what they refer to as the American war. Using "site:" in a search narrows that search to whatever domain and perspective a user seeks on that given topic. Another example might be "Climate Change site:edu," which will return results from academic institutions within the U.S. on the topic of climate change. Extending that search to "Climate Change site:ac.za" will take the user to the perspective on climate change from academic institutions in South Africa. A list of these country domain extensions can be found in a lot of places on the Internet including one online article ("Countries and their domain extensions starting with letters A-E" 2010).

When Siemens (2005) wrote "Capacity to know more is more critical than what is currently known" (p. 8), he was not talking about knowing more of what one already knows or already thinks one knows, but rather using this wealth of information and knowledge to think critically about what they know and why they think they know it. The capacity is not to know more for the sake of knowledge, but is to know more for the sake of understanding and application.

Principle #5: Nurturing and Maintaining Connections is Needed to Facilitate Continual Learning

With the rise of the Internet and the free flow of information, the idea that learning is an individual endeavor that one undertakes alone is no longer true. With the collaborative nature of technology tools and applications today along with over four billion people connected to the Internet ("Internet Live Stats," n.d.), there are few learning activities people undertake alone. Connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity (Siemens, 2005).

A new era of collaboration is here. Collaborations do not just happen; a healthy collaborative environment takes work and care to create, nurture, and maintain. As companies become more global and telecommuting becomes more common, understanding these connections becomes more critical for students. Collaboration in the modern sense of the word really means not only face-to-face collaboration but also collaborating across time and space. Take Twitter hashtags as one example. One online list advertises itself as "The internet catalogue for students, teachers, administrators, and parents [with] over 20,000 relevant links personally selected by an educator/author with over 30 years of experience" (Blumengarten, n.d., para. 1). The site displays Twitter hashtags used by K-12 educators as places to collaborate, share, and learn from one another across time and space. The power of such platforms like Twitter is not in whom one follows or who follows someone but rather in the communities followed and contributed to. One example of this is the twitter hashtag #flipgridfever where teachers connect students around the world using the app Flipgrid.com. One kindergarten teacher in a rural part of Washington State uses #flipgridfever and the Flipgrid app to connect her kindergarten students with others around the world to discuss books they are reading in class, to practice number sense, and to learn about other cultures around the world. The community of educators that have formed around this one hashtag shows the power of connections when we collaborate across time and space.

A 2008 Vanity Fair interview of Steve Case, CEO of AOL in 1985, discusses how AOL approached the Internet revolution. Steve Case offered back then:

> We always believed that people talking to each other was the killer app. And so whether it was instant messaging or chat rooms, which we launched in 1985, or message boards, it was always the community that was front and center. Everything else—commerce and entertainment and financial services—was secondary. We thought community trumped content. (Mayo & Newcomb, 2008, para. 48)

The true power of the Internet and what it offers to learners today is not the content that can be found through research, but rather the connections that can be created with others, the real-time collaboration that can take place, and the power of a just-in-time learning atmosphere that now exists. The website LinkedIn is a perfect example of how nurturing, growing, and maintaining connections has become a vital part of workplaces today. Surveys from just a few years ago show that 92% of recruiters use social media to find top talent. Within that, 87% cite LinkedIn as their top recruiting website (Singer, 2015). Understanding the new connected world of work is vitally important and a skill that must be taught, nurtured, and understood today. Another example of connections that help to foster continual learning is that of collaborative note taking. In a collaborative note taking scenario there is one set of class notes that everyone has access to, adds to, and studies from, including the instructor. As learners go through a class period they take notes collaboratively using a Google Doc or Shared Office 365 Word Document. The benefit to this approach is everyone is responsible for making the notes as valuable as possible for everyone else. The learning community relies on each other in the collaborative process. The instructor also has the benefit of adding to the notes, asking clarifying questions, or fixing any misconceptions before students study and review the notes.

At an International School in Bangkok, Thailand, once students were shown the power of collaborative note taking, they couldn't be stopped. They made collaborative study guides for tests, they shared the notes across time and space, and they had different class periods working on the same set of notes. All of a sudden they had a set of notes that expanded beyond the school day and

included the ideas and thoughts of hundreds of students. The power of creating, nurturing, and using this type of connected environment is essential in a global economy and within academic institutions and corporations today. The work is only as relevant as the quality of the content that is created within it. Therefore students take it upon themselves to make the quality of the content more relevant for each other. Every member of the document has equal stake in the quality of the material being created. The idea of students becoming freeloaders off other students quickly disappears as students learn and understand that everyone's participation is in everyone's best interest. Each student relies on and learns from peers with the instructors alongside. Even the students who make few contributions to the collaborative creation are able to learn by having access to a product that has varied input and that has been mediated by the instructor.

Principle #6: Ability to See Connections between Fields, Ideas, and Concepts is a Core Skill

As these principles start to build upon each other they paint a new picture of what it means to be educated and what it means to be a learner today. Principle #6 of Connectivism starts to bring the theory into focus. When these ideas begin to layer on top of each other, ways of looking at learning through a new connected lens previously inconceivable begins to emerge. The application for students, then, is that they should be asked to use an open and free information landscape and add to the creation of new content. This includes seeing connections between fields, ideas, and concepts, and creating new knowledge from them. In this scenario students may become more active participants in their learning. If it is assumed that learners today can and should be prosumers of information, then learning becomes more than a passive act. Adding value back to the information landscape for the next learner to take and apply is what it means to be a prosumer. Creating situations within learning environments where students must seek out connections between ideas and concepts and then create new meaning from those connections represents yet another core skill in today's connected landscape.

A social studies teacher in an urban school district in Washington State was upset at students for using their school-issued computers to fact check his presentation in real time. As the teacher was giving a lecture the students would interrupt him and correct him based on the quick web searches they were performing. Instead of embracing the new connected world and rethinking how this instant access to information could be used to his and his students' advantage, he decided to ban computers from his classroom.

At a university in New Mexico in 2011, professors were learning how to engage a new type of student, one that was connected and learned through connective means. One professor was frustrated that students were no longer showing up to his class. When probed further, the professor disclosed that he uploads his PowerPoint presentation at the beginning of the week and then during class he takes time to go through the PowerPoint slides. When he was asked what value students would have coming to class if he had given them all the information already in a PowerPoint, he responded "Don't they know who I am?" A little more probing revealed that students were making a copy of the PowerPoint presentation, sharing it amongst themselves as a class, adding their own notes to them, and using the PowerPoint as a collaborative class study guide. The students were already applying the principles of Connectivism without the teacher's help or even knowing it was happening.

Opening the walls of classrooms, sharing data, and allowing students the ability to see connections between fields, ideas, and concepts is not only a core skill but is the work that is done

every day globally. Peer-to-peer interaction is important, and this professor with minor adjustments in how he ran his class could have taken advantage of the connected world within which his students learned. He could still give students the PowerPoint and allow them to learn together. Then, during the face-to-face time he had with students he could encourage them to come up with clarifying questions as well as questions that could deepen the learning and continue the conversation. He could also pose questions to them based on the material he shared and help them see the connections between ideas and concepts they were studying. This would mean no or very little lecture and more hands-on problem solving and application of the concepts by students. Importantly, this shift would also allow for more conversations with students regarding what they understood and where they required more clarification. Peer-to-peer and face-to-face interaction is vital to the education process. How educators restructure that time to take advantage of Connectivism is the engaging work that has potential to truly use time with students in the best possible way. This shift has potential to aid educators in every setting to remain viable and relevant in the eyes of their digital native students.

Principle #7: Currency (accurate, up-to-date knowledge) is the Intent of all Connectivist Learning Activities

In a world that is creating as much information every two days as it did from the dawn of man through 2003 (Siegler, 2010), and the half-life of knowledge is 18 months (Gonzalez, 2004), learning how to find current and accurate up-to-date information is in itself a learning activity. Where Siemens' first principle focuses on learning from others and the opinions of others, this principle focuses on how one continues to keep knowledge current, accurate, and up-to-date in today's fast-paced information landscape. Knowing how to apply built-in search tools to search engines once again becomes a core skill that can be taught to and modeled for students. Using Google.com, for example, a student could search for "Climate Change site:gov" to get a perspective of climate change from the U.S. government. After performing the search they could then click on the tools menu found under the search bar. This creates a new menu that says "Any Time." Clicking on this new menu, a searcher can choose what time frame they would like results to be shown. As of this writing, doing just that offers over 100 web pages that have been updated by the U.S. government just on the topic of climate change within the past 24 hours. Changing the setting to the "past hour" produces 20 web page results. But what about the accuracy of these results? Many would assume that what the US Government would post about climate change would be "accurate." But is it? Especially given the current debate taking place about if climate change even exists? Further, does everyone assume epa.gov will offer the most accurate information on climate change today? Accuracy is important, and, at the same time, the diversity of opinion and the ability for multiple voices to be part of the debate and discussion is what precludes the consumer of all information to carefully evaluate its accuracy given the source as well as other variables.

The ability to access up-to-date information has never been easier, and the need for users to critically analyze that information for accuracy has never been more important. These tools and methods that bring information to users' fingertips are not new; they have been built into search engines for years and represent core skills today's researchers rely on to get current, accurate information. In 2011, Dan Russell, a search anthropologist at Google, revealed that an internal study done at Google found that 90% of Internet users did not know how to use CTRL/Command + F to find a word in a document or web page (Madrigal, 2011). The CTRL/Command + F command or "find" command does just that. It lets users search for and find what they are looking for within a

document or a particular web page. If 90% of users do not know the find function exists, then an opportunity presents itself to educate others about the vast search tools that exist within search engines today. Currency and accuracy are not only important principles of Connectivism; they are an important part of academia today. Knowing how to use these new search tools in a connected, fast-paced, always-changing knowledge environment is crucial to learning.

Principle #8: Decision-making is itself a Learning Process

The subtext of this principle includes: "Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision" (Siemens, 2005, para. 15). This last principle can best be summed up by the BREAKING NEWS atmosphere of today. Breaking News is constantly happening. This, in a connected information world, makes sense. Things are always changing or "breaking." Information is being released, updated, analyzed, or created all the time. The result is a constant, shifting reality of truth. Because the alteration of information is happening so quickly people are trying to understand situations that are constantly in flux. Educators should now be challenging their students to be critical consumers of all content they encounter. This is a vital core skill.

Because of this new era, deciding who to learn from, who can be trusted, and more importantly *why* a source can be trusted are important questions one must constantly ask. Being able to make decisions about information sources is itself a learning task. Constantly evaluating sources is a core life skill of the information age.

At the same time, deciding what to learn and when to learn it, and from whom to learn it, is also a skill that needs to be honed. The site YouTube.com brings this into focus. Searching YouTube videos helps people learn precisely what they want at the moment they want to learn it. This is the just-in-time learning environment of today. YouTube might be the largest video repository on the Internet, but what really sets it apart from the competition is its search capability. YouTube is considered a search engine due to its impressive algorithms that accurately locate the content the searcher is looking for with very little effort on the user's part. YouTube is the second most popular search engine behind Google (Blattberg, 2015) and quickly climbing towards the number one spot. When searching YouTube for the perfect video, a user must decide from whom they want to learn. That decision-making process is in itself a learning process. When choosing a YouTube video, a user takes into account many data points. How long is the video? How many other people have watched it? Does it have any "thumbs ups"? Does the description match what the searcher is hoping to learn? Understanding all of this information and then choosing which video to watch is a skill practiced in order to maximize the learning.

Conclusion

Knowledge is quickly becoming measured by how fast one can *learn*, *unlearn*, and *relearn* information in today's world. Embracing the change to a just-in-time learning environment represents immense engagement potential for educators and their students. Today's learners, in both K-12 and university classrooms, have grown up in an information overload world, and although research is still a core skill to be taught, the skill set involved in teaching it looks quite different than it did before the Internet and its astute applications and search engine tools were widely accessible. A new subset of core literacy skills has emerged as a result. This presents an incredible opportunity

for educators. Instructors can now encourage and model connected learning environments for their students. Collaboration, both locally and globally, does not need to be limited only to in-person connections, but rather can occur across time and space.

At the same time, today's educational institutions may benefit from conversations around what it means, in the age of the Internet and intelligent online tools, to be knowledgeable and educated. Perhaps simply knowing something is not nearly as important as knowing how to learn something new in the moment one wants to learn it, and being able to apply it all in a connected, ever-changing, information landscape. Transitioning to a focus wherein educators teach students additional core literacy skills including how to practice criticality in consuming online information and its sources, how to build upon existing information, how to make connections among multiple sources of data, and how to apply the information, has potential to help classrooms and educators maintain a relevant role in their students' education.

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Jeff Utecht is an educator, author and educational technology consultant working with K-12 and university systems globally. He has authored books, works as a consultant for technology startups, and continues to speak at schools and educational events around the globe. In 2018, he was invited to the Global Knowledge Summit in Dubai to be part of a global conversation about the future of education in the Knowledge Economy. To date, Jeff has supported over 20 1:1 laptop deployment programs both within the US and internationally and has taught at several universities as an adjunct professor since 2007.

Dr. Doreen Keller is an associate professor at Whitworth University in Spokane, WA. After teaching high school English for eleven years, she transitioned to higher education. In her current role, she leads faculty members in aligning common assessments to the edTPA and provides professional development for various audiences several times each year. Active lines of research include place-based education, edTPA preparedness, and equity and access in education. She recently authored an article about her place-based education study in Interdisciplinary Environmental Review, an international journal. She has also co-authored a chapter for the forthcoming book *A Practical Guide for edTPA Implementation and Success*.