Developing Digital Literacy in Teachers and Students

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Abstract

This article discusses the development of digital literacy in teachers and students. A discussion of digital literacy concerns in the various K12 constituent groups associated with the educational system is investigated. Data from an implementation study are included that confront the topic of the impact of teacher enthusiasm for the digital tools available to them on student achievement. The concept of apperception is also discussed with respect to how it impacts the building of digital literacy. Finally a model for building digital literacy is included through the lens of protocols that have been experienced by the author in various environments.

Key Words: digital literacy, technology, integration

Digital Literacy for Teachers and Students

The teaching of literacy in schools is an age old tradition. Literacy, generally, is a competence or knowledge in a specified area. For decades the term literacy was much more narrowly defined in our schools than it is today. Literacy was thought of mostly as the ability to read and write in a particular language. Other types of literacy were expected to be taught at home. For example, the social conventions of how to dress in various situations, how formally to speak to certain audiences, when to use the proper fork at a dinner party, were all taught at home. Some may argue the importance of these literacies, but it is clear that there are uneven amounts of resources available to teach these literacies in certain areas. If a particular literacy is deemed important by a community or culture, schools have a moral responsibility to help students develop that literacy. Another literacy has emerged that is much more generally agreed upon as a priority, digital literacy. The issue becomes that we need to define what digital literacy looks like in a given setting. Ward, for one, believes that digital literacy in schools is mostly about a pedagogical approach to learning. (Ward, 2015) Ward goes on to say that digital literacy is a process that needs to be developed in similar ways to language and mathematical literacy.

A decade or more ago there was an influx of technology into the schools almost nationwide. Poorer communities were able to find funding from philanthropic organizations to get the technology, wealthier communities were able to allocate funds of their own. As these technologies became available, schools were given the task of determining how to implement the use of these tools into their classrooms. Getting the computers was only the first step. At that point the next steps were about software and training for teachers. In the last decade, the focus has shifted significantly. The exponential growth of online resources has created opportunities not thought of in the original implementation plans of the technology boom. An important literacy has emerged due to the availability of online resources: digital literacy. One integral element of digital literacy is "knowing" where to go in order to get trusted information in the online setting. Teachers find themselves in a potentially uncomfortable situation. They need to teach their students how to authenticate online resources, but the perception is that the students are much more familiar with the technology then are their teachers.

Marc Prensky (2001) writes about the digital natives who have grown up with this technology that was always available to them, and the digital immigrants who were taught in a different way, before this availability. While our students are certainly mostly digital natives, they haven't necessarily been taught how to authenticate the information they see online. They are prone to use resources such as Wikipedia, or another site of that ilk, for information. This comment is not meant to disparage Wikipedia, nor sites like it; in fact those sites are an important part of what the internet can provide. The issue with them is the concept of shared ownership. Most of the time the information on these shared sites is accurate. When someone puts incorrect information on there, it is corrected by another user. But at any given instant, it cannot be thought of as an academic source since its accuracy cannot be verified by that site alone.

The thoughts about authentication of online resources are not new. Alan November (2008) was talking about this to anyone who would listen as far back as the 1990s, when the availability of information online was in its infancy. I remember hearing him speak in a small setting in the late 1990s where he showed an example of a website purported to be information about Dr. Martin Luther King, Jr. It looked like a valid site, had pictures, links, etc. However the information on the site was grossly inaccurate, intentionally false and defamatory. He went through an exercise of seeing who was hosting the website, and what other websites they were hosting. When you traced back a couple of levels, you could see the host of the site was also the

host of a white supremacist site. This exercise has stuck with me and informed my use of the internet in my teaching ever since. More importantly, I have made it a priority to attempt to get my students to develop digital literacy of their own. Hughes (2014) agrees that "there should be a culture in education and in the workplace that would lead to a more lifelong approach because no one had the digital skills they would need in five years time, let alone in 50 years." (p. 8) Giving students the experience of developing digital literacy is therefore a life-long skill that they will need to keep up with emerging changes in the digital realm.

It is important to begin developing this digital literacy as early as possible. Khoo, Merry and Nguyen (2015) found that the iPad is motivating to young children's developing literacy and learning skills. It is important to remember that the tool itself is secondary to the type of access it gives to students and how we choose to use the tool.

Another way to develop digital literacy with students is to create a controlled online environment. There are resources available where you can create your own search engine for a group. When the students use this search engine the search only goes to sites that the teacher has included as website options. If the instructor simply creates the site, one goal will be accomplished. You will know that the information the students are accessing is valid. They need to understand how the suffix of the website (.net, .com, .gov, .org) might influence the credibility of the information on the site. However, if the teacher creates the list of sites together with their students, the students will be developing the digital literacy as well. As students progress through school to the later grades opportunities to develop this digital literacy without scaffolding need to be provided as well.

To understand how to help teachers develop digital literacy, it is important to consider the concept of apperception. Apperception is an important, and often overlooked, concept in learning across disciplines. In psychology apperception is defined as perspective. A "big" snow storm in a southern state might not be looked at in the same perspective should the same number of inches fall in Chicago. In philosophy apperception is really thought of as experiencing new stimuli. In the general field of education apperception is about connection. How does new information fit with what the student already knows? How do they match the new idea with their prior schema?

Specifically in the field of teaching this term is more about how the teachers learned the information themselves. When I was a high school teacher and was teaching a calculus theorem to my students, my first point of reference was how it was taught to me when I was a calculus student. The issue with this concept is that many of us weren't taught in an era where the technology was available. So many teachers, especially those that grew up in the time frame described above, don't have a point of reference from which to think about teaching this concept.

Although universally thought of as an important piece of the educational setting today, every constituent group has their concerns about the integration of technology. School administrators have concerns that include policies about the use of the technology. Most germane to this topic is the acceptable use policies (AUP) that schools have created, which spell out in detail who is allowed to use the technology, when they are allowed to do so, and for what purposes. There has been an evolution in AUPs over the last decade as well. Early on, AUPs were very restrictive. I taught in a district that had policies in place that required any student wanting to use a school computer to have a detailed permission from a teacher. If a student got a pass from a history teacher to work on a paper that was all they were allowed to do. If they finished their history paper and wanted to move on to doing some research for their biology class, it was not allowed per this restrictive policy. Steadily more reasonable discretion has built

better AUPs that make sense for allowing the students to be productive users. One possible reason for this progressive thinking is that the younger teachers who were more likely to be digital natives are now becoming administrators and giving input into these policies.

In addition to the AUP, administrators are worried about cyberbullying. Between social media and texting, the concept of bullying has become an epidemic. A generation ago students were bullied in person. The pervasiveness of social media and texting has opened up new channels to pick on other children. We have all read the awful stories of what bullying can lead to. Too often we hear about bullied students who hurt themselves and/or their classmates.

Administrators are also concerned about the financial and time related costs technology. The initial cost of the hardware is substantial, but so are the costs associated with training, repair and maintenance, and connectivity. Moore's Law determined that technology doubles in speed and therefore becomes obsolete every 18 months. There are some large investments made, and they come with continued financial and time investments to stay current.

Because of all of the time and money invested in these tools, administrators are very sensitive to using the technology well. Technology is not always the best tool for the job, but when it is, our teachers need to have the skill set to optimize its use. The term "death by PowerPoint" refers to a teacher that uses the software PowerPoint to simply digitalize their lecture notes. A teacher that is accused of this would simply be reading what is on the screen. This would be an example of when technology isn't the right tool for the job. However presentation software like PowerPoint, Prezi and others can be an excellent tool when used well. This tends to happen when the display is used for the scaffolding of the idea being discussed, rather than trying to fit the complete idea on the screen.

As is the case in almost every corner of our educational system, administrators have to be concerned about equity of availability of resources as well. Mostly, this concern is with regard to students having access to the technology. We cannot have our teachers requiring something outside of school time that requires using technology if the students do not have access to it.. In some more economically challenged areas, grants are written to move to a "one to one" environment. "One to one" refers to each student having their own device. They sign out the devices as they used to sign out textbooks for the year. However there is much more of a risk of damage or loss, and a bigger price tag to replace the item, than when students were signing out textbooks. In some wealthier communities, the students already have cell phones or other devices, either handheld or in their home, that gives them access.

Along with the hardware access concerns are the inconsistency of a wireless infrastructure in some parts of the country. The availability of access to the internet can be spotty in very rural areas, or in areas where there is a large population trying to wirelessly access a network that isn't capable of handling such a big demand. There are some local and national projects that are looking to fund large scale solutions to this issue. The evolution of 3G, then 4G infrastructures has made strides towards solving this issue for some types of devices.

Teachers also have concerns about the integration of technology into their teaching that impacts the development of their own digital literacy. The first and most major concern for teachers is the concept of multiple stimuli. The theory of apperception discussed earlier comes into play here too. The optimal environment for a digital immigrant to complete work can vary from the optimal environment for a digital native. Most digital immigrants need a quiet space, free of distractions and other stimuli to be most productive. Digital natives are used to multiple stimuli and that is how they are most comfortable.

Consider the way digital immigrants acquired information. They got their news from either the morning newspaper or the 6:00 or 11:00 news on the television. With the exception of USA today, most of those newspapers were black and white print, and articles in the paper were linear and uninterrupted. When digital immigrants watched the nightly news there was typically one person on the screen, perhaps with a picture about the event being discussed over his shoulder. The people delivering the news tended to be similar as well. It appeared that TV executives believed that older white men were going to be the ones that people trusted to give them information. There were certainly some that broke these stereotypes, but the majority of newscasters of this era fell into this category.

Now let's consider how digital natives acquire information. The distribution of newspapers has fallen significantly. Information is now acquired mostly in one of two ways, either online or via the television's 24 hour news cycle. The 24 hour television news cycle has substantially changed how the delivery of news looks to the consumer. No longer is there one old, white male on the screen delivering the news. In fact there are now typically multiple people on the screen at once, often a diverse group of races and gender. They don't remain on any one topic for very long. Opinions and facts are communicated interchangeably. At any given time while the majority of the screen is taken up by the aforementioned people delivering news there is typically a ticker at the bottom of the screen that is giving some running news, either headlines, sports scores, or stock values. The left side of the screen is also often devoted to a list of upcoming topics, presumably to attempt to keep viewers on their station to hear the news about one of those topics that interests them. The viewers are also not paying 100% attention to the screen. They are doing multiple tasks at once. Multiple stimuli is the norm with digital natives. Yet, when it comes to how they are coached in school (or outside of school) to perform tasks, it is in the old paradigm of a quiet, formal, often cold space free of "distracting" stimuli. Because of apperception, that is how many teachers believe their students can be most productive. However that is not the environment that they gravitate to when left to their own devices.

When I was a high school teacher I would periodically survey my students. I'd do so for multiple reasons, to get information to improve my teaching, to optimize learning situations for the students, and to get to know them better. One of the surveys that I would repeatedly use during the first couple of weeks of school was about their study environments outside of school. Sometimes just asking the questions could influence them to think about their learning spaces and how that works, or doesn't work, for them. This informal data collection yielded consistent results. The students do not sit at home at the dining room table to do their school work. They are at a computer, there is social media with which they are checking in, there is music or the television on in the background, they are texting and on rare occasion they are also working together in physical proximity. They are always in virtual proximity and interacting that way (text or social media). The other thing that came up repeatedly was their first inclination if they ran into any confusion about their school work. Their first stop was the internet. Since this is their starting point to get information, we need to make sure that they are digitally literate about where to get accurate and complete information. We need to steer them towards scholarly sites. They need to be prudent consumers of this information. They need to be sure to authenticate the sources they are using. When they do find authentic resources, they also need to know how to properly cite these sources to avoid plagiarism.

As a side note plagiarism is a big issue at both the high school and collegiate levels. In speaking to students that I know to have plagiarized work, it is evident that the majority of them

don't really understand how simple it is to cite what they are finding and therefor avoid this pitfall. The building of digital literacy is an important part of the solution to this problem as well.

As was the case with administrators, access to technology outside of the classroom is a concern of teachers as well. When a teacher gives an assignment to their students, they want the students to be able to get the outcomes of the assignment without wasted efforts and energy on finding ways to access the technology. They also want to minimize the excuses for students that don't complete the assignment.

Inside of the classroom teachers have concerns as well. When I speak to teachers about their use of technology I perform an exercise where I force them into rating their openness to technology use in their classrooms. Those that are on the low implementation end of this scale voice two major concerns. Their first concern is that technology doesn't always work. I believe this is less and less of an issue as technology becomes more reliable, but it was something that would often derail a class in the earlier days of implementation. A teacher would spend a great deal of time and effort setting up some part of the lesson that used technology and the internet would be down, or the bulb in the projector would go out, or some other technology would fail and the teacher would have wasted that time, and then have to think quickly about how to move forward with the class.

The other concern that they voiced most often was that felt students would use technology to cheat. If the technology was being used to perform the assessment they were worried about them sending information back and forth. Even if the assessment was more traditional in style, the teachers were worried about students using computers or phones to cheat by using their devices to communicate with each other. These teachers that were nervous about implementation of technology in their classes were comfortable voicing these concerns. However, the bigger concern was bubbling underneath the surface. Their real concern was the shifting role of the teacher in the classroom.

Teachers, especially those that are digital immigrants, are not necessarily the expert in every facet of the classroom if the students know more about the technology than they do. It is ingrained in teachers that they are to be "in control" of the classroom. That is the learning environment in which most of them went to school. It is also built into the instruments upon which they are being assessed. If teachers give up some control of the classroom, they need to change their approach to what goes on in their classroom. The progressive writings on this topic call the role "guide" or "coach". You may call it whatever you would like to, but it isn't what they have seen done effectively and understandably, it is something that makes many teachers nervous.

Many teachers fall into these category of being less than enthusiastic about using technology in the classroom. I set out to see if this lack of enthusiasm would impact student achievement. I looked at 361 students in 19 high school mathematics classrooms in Connecticut. These schools were from a wide array of economic reference groups (ERGs) as designated by the State Department of Education. The teachers were given a survey to ascertain their level of enthusiasm with respect to the implementation of technology in their classroom, and to measure the amount of their implementation. Their students were then asked to complete an instrument that had two parts, one where they were allowed to use a graphing calculator and the other where they were not allowed to use the device. I broke these teachers into four groups, high enthusiasm- high integration, high enthusiasm- low integration, low enthusiasm-high integration,

and low enthusiasm- low integration. I compared these four groups' students with respect to each other using an ANOVA.

Enthusiasm-Integration	H-H	H-L	L-H	L-L
Calculator	7.1	6.9	5.0	5.2
Non-calculator	7.1	6.9	5.4	6.0
n	83	112	145	21

Table 1: Teacher Enthusiasm vs Integration of Technology

When comparing these four groups there were some predictable outcomes for the calculator portion of these data. Both of the low enthusiasm groups (high or low integration) scored statistically significantly lower on the calculator portion of the instrument. The conclusion that can be drawn from this is that, for these students, the more enthusiastic the teacher is about the technology implementation the better their students did on the calculator tasks. This isn't a surprise. We know that teachers impact student achievement in many ways. Certainly it is reasonable to hear that students that had teachers that were enthusiastic about the technology would produce students that performed better with the calculators available to them.

The more interesting data came from comparing the results on the non-calculator portion of the assessment. When comparing the four subgroups only one statistically significant difference emerged. That was when comparing the low enthusiasm- high integration group with respect to the two high enthusiasm groups. Students in the low enthusiasm- high integration group did statistically significantly worse than the two high enthusiasm groups. The difference didn't exist when comparing the two high enthusiasm groups to the low enthusiasm- low integration group. The conclusion that could be drawn here is that, in these students, those that had teachers that didn't really believe in the use of the technology, but used it a lot anyway, performed worse even on the non-calculator portion of the instrument. This has long been a concern specific to math teachers, that the overuse of technology could become a crutch that could atrophy the paper and pencil abilities of the students. At least from these data, it appears that this is only true when the teachers go against their beliefs and implement a great deal of technology even when they don't believe it to be the correct tool.

Part of being a digitally literate teacher is knowing what is available with respect to resources (both electronic and otherwise) and making good, data driven decisions about how to best teach a particular topic. The model of building a digitally literate teaching force that works best in my experience is one that starts with a small group of able and interested teachers and grows from there. In this model a handful of teachers begins in year one with training. The enthusiasm of this group is incredibly important. Their internal motivation is the key to this working. Building on the enthusiasm they already have will be what draws in their fellow teachers in the next phases of this model. This group of teachers needs three things, sustained training, tangible benefits and regular accountability.

The one-time professional development model does not have sustainable impact on teaching. Teachers that go to a one-time training report high energy immediately after the training, but the implementation and the enthusiasm dissipate if there is not follow up. Teachers need to have regular trainings and professional development that is ongoing over the entire first year of the project. They need to have real world connections that they can use immediately in

their classrooms, and that they can see results from immediately. I would recommend that these trainings be very focused and that they spend time as a group taking the new stimuli and finding direct connections to the teaching that they can use the next day. Start with an interest inventory of these teachers and see where they would like to begin. Use this information to start with topics that interest them most.

The next thing that this phase of the training needs is to have tangible benefits for these teachers. This could be in the form of workload reduction, additional compensation, or extra professional development money. More importantly this benefit needs to have increased access to technology. Depending on your model, this could be a free device, subscriptions to paid sites or applications, or something else that they can use in their teaching immediately. All of these will capitalize on their enthusiasm and ability to implement technology well.

Lastly there needs to be regular accountability that comes along with these opportunities. This accountability is simply to get them into the routine of using data to see if what they are doing is working or not. The mindset of failure being a bad thing needs to be challenged. In this phase, trying something and it failing is important data to be used in making further decisions. This can be a challenge. Teachers are not wired to believe that it is acceptable to fail at anything. A method that we used in order to attempt to minimize this concern is to treat the data as shared data. The data we are collecting may be from the classroom of one of these teachers, however as the group looks at the data the ownership shifts to the entire group. The facilitator of the frequent, ongoing meetings will refer to the data being examined as "our data". What does our data tell us about this tool? What does our data lead us to think about its match with the topic being taught?

After a year of phase one, these teachers become the most important piece in phase two. Phase two is trying to implement on a larger scale in the school. Depending on the size of the school and the funding available for resources it might be the entire school or a subset of the school. Spend time at the end of the first school year giving the original group of teachers the opportunity to disseminate information about the experience. I've seen this done well in a couple of different venues including small or large group settings. This, along with word of mouth, will be how you spread the successes of this group. The phase one participants also become the trainers of groups the following year, guiding them through processes similar to what they experienced.

Students have their own set of concerns about digital literacy. First of all, as digital natives, they often think they are inherently digitally literate. This belief is true in many ways, but their digital literacy typically doesn't extend to the academic use of technology. They are quite familiar with the devices and interfaces, but not necessarily with what we need them to understand to most effectively use technology as a learner. One of the first shifts that happens is that some of the burden of learning gets thrust onto them. They are required to be a more active part of the learning process. This is one of the major benefits of this paradigm shift. Passive learning environments need to become more active. Students are required to be more a part of their own learning. This enhanced role might appear in flipped classroom settings, in more group work inside of class, and in more structured online work even outside of the classroom.

Students are now asked to be peer editors and critics. They are asked to become teachers of new information. In order to teach their peers, they need to learn how to assess understanding, which requires an understanding of formal and informal assessment and grading plans, perhaps even rubrics. Students now require the development of the digital literacy to identify online resources that are appropriate on their own.

In all, whether you are working with administrator, teachers or students, there are some common things that need to happen in order to develop a digitally literate learning environment. The infrastructure needs to be in place. If your plan requires the use of the internet, make sure you have the wifi and bandwidth to accommodate what you are asking the community to do. All parties involved, including parents, need to be a part of the development of a protocol that is appropriate for the community.

Most change in the field of education is created by a leader, or group of leaders, with a big personality. The only way to have sustaining change is to move beyond the personality and alter the culture itself. This requires a commitment from the entire school, teachers and students, or it will eventually revert back to the old paradigm when these people are gone. The most important piece in this change is the shift comes from those within the culture, not simply from above.

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