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Jonathan D. Becker
Virginia Commonwealth University, jbecker@vcu.edu

Cherise A. Hodge
Virginia Commonwealth University

Mary W. Sepelyak
Virginia Commonwealth University

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ASSESSING TECHNOLOGY LITERACY:

THE CASE FOR AN AUTHENTIC, PROJECT-BASED LEARNING APPROACH

A white paper

Jonathan D. Becker, J.D., Ph.D.

Cherise A. Hodge, M.Ed.

Mary W. Sepelyak, M.Ed.

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EXECUTIVE SUMMARY

Section 2402(b)(2)(A) of Title II, Part D the ESEA (titled Enhancing Education Through Technology (EETT)) states that one of the goals of EETT is "[t]o assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability." Despite the fact that this technological literacy expectation of NCLB has not been given the same priority as the core content areas, there are still well-organized and well-funded efforts to advance technology education in schools. This movement is evidenced by the growing strength of organizations like the Partnership for 21st Century Skills and the pending administration of a NAEP computer-based assessment of technology and engineering literacy.

While battles over defining technological literacy continue to rage on, 49 of the 50 states have technology literacy goals and standards. Furthermore, across nearly all definitions of technological literacy, there is agreement that the construct is multidimensional and that the dimensions are interdependent and inseparable. Action or "doing" is one central dimension of technological literacy. If "doing" is central to technological literacy, then leading schoolchildren towards greater levels of technological literacy requires a commitment to a theory of learning where doing is also central. Constructionism is a theory of learning that shares key concepts of the more familiar theory of constructivism. Moreover, where constructionism is the theory of learning, one application of that theory is project-based learning (PBL).

In PBL, the project is the curriculum and testing is not separate from learning. Additionally, since "doing" is central to technological literacy, i.e. where decision-making and capabilities are important parts of a multi-factored definition of technological literacy, traditional assessments will not work. Furthermore, not all dimensions are easily assessed. "The most difficult dimension to assess is the capability (or doing) dimension, which includes design activities. This dimension simply cannot be fairly assessed via a paper-and-pencil test" (Gamire & Pearson, 2006, p. 47). In other words, a knowledge-based assessment is insufficient on its own. If such an assessment is used, it should be used as a base in combination with a performance-based, portfolio-based, or project-based assessment.

A review of existing technology literacy models and assessment shows that the TechYES technology certification program, developed and implemented by the Generation YES Corporation using research-based practices, is designed to provide educators a way to allow students to participate in authentic, project-based learning activities that reflect essential digital literacies. The TechYES program includes an excellent, authentic, project-based method for assessing student technology literacy and helps state and local education agencies satisfy the Title II, Part D expectations for technology literacy by the eighth grade.

1.0 Why Technology Literacy?: Situating the technology literacy "movement" within the current educational policy climate

At a time when nearly every aspect of society has been impacted by rapid changes in technology, it is not surprising that there is growing support for technology education and technology integration in schools in the United States. In 2004, the International Technology Education Association (ITEA), in partnership with the Gallup Organization surveyed 800 adults and determined that 98% of the respondents believed that the study of technology should be included in the school curriculum. That represented an increase from 97% in 2001 (Rose, Gallup, Dugger & Starkweather, 2004).

Around the same time as the original ITEA survey, the federal Elementary and Secondary Education Act (ESEA) was reauthorized through the No Child Left Behind (NCLB) Act (2001). Most educators and citizens know NCLB for its dramatic emphasis on standards, assessment, and accountability. Furthermore, NCLB is commonly associated with core academic subjects such as English/Language Arts and Mathematics. While core academic subjects are clearly emphasized, it is also the case that the act requires that all states report "technology proficiency" by eighth grade. Title II, Part D of the ESEA is titled Enhancing Education Through Technology (EETT). Section 2402(b)(2)(A) of Title II, Part D states that one of the goals of EETT is "[t]o assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability." (http://www2.ed.gov/policy/elsec/leg/esea02/pg34.html).

However, the legislation leaves it to each state to define technological literacy and to determine how proficiency will be assessed. According to a United States Department of Education technical guide "[t]he definition of 'technologically literate' is determined by the state. A state may determine whether students are technologically literate in a number of ways including through statewide technology assessments, course

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completion, direct observation, assessments or criteria tailored by individual LEAs, or other means." (www2.ed.gov/about/inits/ed/edfacts/eden/non-xml/n117-5-0.doc)

Currently, 49 of the 50 states have technology literacy goals and standards; more than 80 percent of the states have adopted, adapted, or referenced International Society for Technology in Education's (ISTE) National Education Technology Standards in state department of education documents. As of 2007, based on a survey conducted by the State Educational Technology Directors Association (SETDA), 21 states reported that they use the ISTE NETS definition (i.e. the six categories of the NETS-S), 15 states reported using a unique state definition, eight states reported using the SETDA definition[1], and seven states reported that they used another method for defining technology literacy. Those varying definitions have been operationalized in the form of technology standards. That is, states encourage the pursuit of proficiency in technological literacy by promulgating student technology standards. There is no shortage of standards for states to adopt or adapt. The International Technology Education Association (ITEA) has developed a series of standards that point out in great detail how one might achieve technological literacy. Those standards, the third iteration of which was released in 2007, include grade-level goals. Additionally, in 2007, the International Society for Technology in Education (ISTE) released the second iteration of the National Educational Technology Standards for Students (NETS-S).

Some states have standalone technology standards, while others have technology standards integrated into the core content curriculum standards. Where technology standards are integrated, the language tends to be vague; standalone technology standards tend to be more specific. Some states have both standalone technology literacy standards and core-content area standards that show evidence of technology literacy being well-integrated into their curriculum, demonstrating either a cross-reference to academic standards or specific statements reflecting tenets present in the standalone technology standards.

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[1] "...the ability to responsibly use appropriate technology to communicate, solve problems, and access, manage, integrate, evaluate, and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills in the 21st century."

While nearly all of the states have technology literacy goals and standards, assessment around those standards varies greatly across the states. "For students in K-12 schools, 24 percent of states have set and assessed standards and an additional 58 percent of states have standards in place, but not yet assessed" (SETDA, 2007). Only five states require uniform assessment of proficiency at or before the eighth grade. When required by the state, assessment usually consists of a state-created survey, a state-created rubric-based assessment of student proficiency, or a commercially-purchased computer-based test. Thirty percent of states require each individual school district to administer a formal assessment while 68% have no such requirement. Assessments chosen by individual school districts vary widely and may include such things as an electronic portfolio, computerized test, project creation, survey, or direct observation.

Despite the fact that the technological literacy expectations of NCLB have not been given the same priority as the core content areas, there are still well-organized and well-funded efforts to advance technology education in schools.

This variation in standards and assessment across the states renders it very difficult to know if standards are being met or if students are proficient on stated standards by the eighth grade. Thus, despite the language of NCLB, there has been selective enforcement of the requirement to assess and report on student technological literacy levels. According to Don Knezek, the chief executive officer of ISTE, "negative leadership" on the part of state education departments has "cut seriously into 8th graders' tech[nological] literacy" (Cech, 2008)

Despite the fact that the technological literacy expectations of NCLB have not been given the same priority as the core content areas, there are still well-organized and well-funded efforts to advance technology education in schools. One noteworthy effort is being led by the Partnership for 21st Century Skills. The Partnership for 21st Century Skills (P21), a national organization made up of business, government, and education leaders, serves as a proponent for student acquisition of 21st century skills by providing educational resources and advocating for local, state, and federal policy implementation.

P21's Skills Framework fuses traditional core academics with 21st century skills and content while building information and communication technology skills. "The Framework presents a holistic view of 21st century teaching and learning that combines a discrete focus on 21st century student outcomes (a blending of specific skills, content knowledge, expertise and literacies) with innovative support systems to help students master the multi-

dimensional abilities required of them in the 21st century" (Partnership for 21st Century Skills, 2010).

P21's mission is to "serve as a catalyst to position 21st century readiness at the center of U.S. K-12 education by building collaborative partnerships among education, business, community and government leaders" in order to address the perceived gap between the knowledge and skills needed in the workplace and those acquired in school (Partnership for 21st Century Skills, 2010). In addition, it provides guidelines for standards, assessment, program implementation, professional development, and a Skills Framework among other resources.

The NAEP computer-based assessment of technology and engineering literacy is a clear indicator that technological literacy is to be taken seriously and an important policy consideration for state and local education agencies.

On the heels of the P21 efforts, the National Assessment Governing Board (NAGB), an independent, bipartisan board that sets policy for the National Assessment of Educational Progress (NAEP), recently approved a framework for a NAEP computer-based assessment of technology and engineering literacy. That assessment is targeted for a 2014 launch. The date is a few years in the future, but the fact that NAGB is committed to assessing technology and engineering literacy on a national scale is an important milestone for the efforts of those committed to improving technological literacy of school-aged children. Especially in consonance with the growing presence of the Partnership for 21st Century Skills, the development of the NAEP computer-based assessment of technology and engineering literacy is a clear indicator that technological literacy is to be taken seriously and an important policy consideration for state and local education agencies.

2.0 What is technology literacy?: Giving some definition to the construct

The NAGB was originally charged with leading the development of a technology literacy NAEP targeted for 2012. Along the way, engineering literacy was added to the assessment and the timeline was pushed back to 2014. These changes, along with the expansive definition of technology literacy included in the initial framework, suggest that there have been "turf battles" over the assessment and what exactly should be assessed through NAEP. These definitional problems have plagued the technological literacy in education movement for years. Technological literacy, like many other constructs, is not as hard to define as it is to find a definition that is widely acceptable and workable across different contexts. The International Technology Education Association (ITEA) defines technology literacy as the ability to "use, manage, assess and understand technology" (2000/2002/2007, p. 9). Similarly, the National Academy of Engineering (NAE) and National Research Council describes technological literacy as encompassing "three interdependent dimensions – knowledge, ways of thinking and acting, and capabilities" (Pearson et al., 2002, p. 33).

The Committee on Assessing Technological Literacy of the NAE and National Research Council (NRC), slightly modified the NAE's 2002 definition and produced a set of characteristics of a technologically literate person (Garmire & Pearson, 2006) (see Figure 1).

A person cannot have technological capabilities without some knowledge, and thoughtful decision-making cannot occur without an understanding of some basic features of technology. The capability dimension, too, must be informed at some level by knowledge. Conversely, the doing component of technological literacy invariably leads to a new understanding of certain aspects of the technological world (Gamire & Pearson, 2006, 37-38).

The Committee on Assessing Technological Literacy of the NAE and NRC's definition of technological literacy points out one major commonality across definitions: technological literacy is multidimensional and complex. The three dimensions of technological literacy are also interdependent and inseparable.

This definition of technological literacy points out one major commonality across definitions: technological literacy is multidimensional and complex. The Committee adds that the three dimensions of technological literacy are also interdependent and inseparable. There are any number of ways to depict the multidimensionality and interrelatedness of the components of technological literacy. One such depiction is Figure 2, developed by the Committee on Assessing Technological Literacy of the NAE and National Research Council (NRC).

Figure 1. Characteristics of a technologically literate person

Knowledge
- Recognizes the pervasiveness of technology in everyday life.
- Understands basic engineering concepts and terms, such as systems, constraints, and trade-offs.
- Is familiar with the nature and limitations of the engineering design process.
- Knows some of the ways technology has shaped human history and how people have shaped technology.
- Knows that all technologies entail risk, only some of which can be anticipated.
- Appreciates that the development and use of technology involve trade-offs and a balance of costs and benefits.
- Understands that technology reflects the values and culture of society.

**Critical Thinking and Decision Making**
- Asks pertinent questions, of self and others, regarding the benefits and risks of technologies.
- Weighs available information about the benefits, risks, costs, and trade-offs of technology in a systematic way.
- Participates, when appropriate, in decisions about the development and uses of technology.

Capabilities
- Has a range of hands-on skills, such as operating a variety of home and office appliances and using a computer for word processing and surfing the Internet.
- Can identify and fix simple mechanical or technological problems at home or at work.
- Can apply basic mathematical concepts related to probability, scale, and estimation to make informed judgments about technological risks and benefits.
- Can use a design-thinking process to solve a problem encountered in daily life.
- Can obtain information about technological issues of concern from a variety of sources.

Source: Adapted from NAE and NRC, 2002.

Figure 2. A Visual representation of the components of technological literacy.
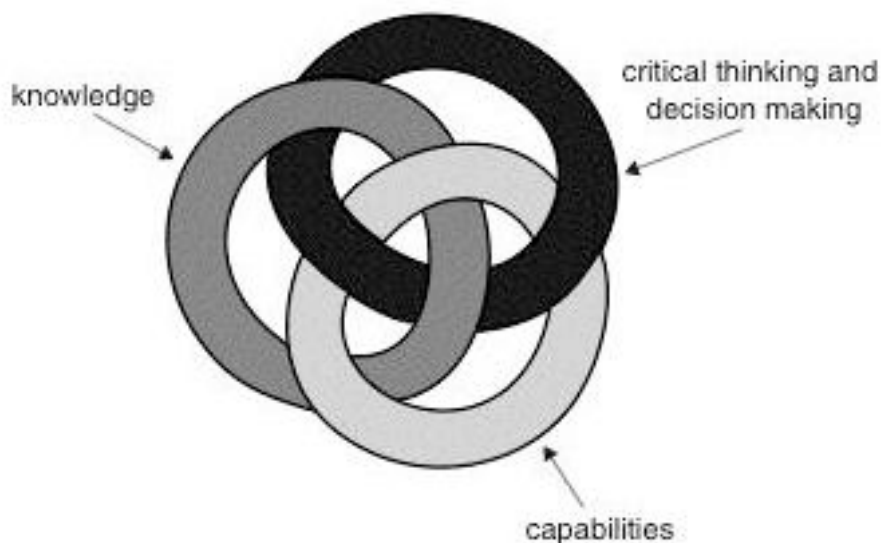
SOURCE: Gamire & Pearson, 2006, p. 38

"We argue that 'doing' holds a central position in all aspects relating to both technology and technological literacy."

(Ingerman & Collier-Reed, 2010, p. 2)

Along the same lines, and particularly emphasizing the capabilities aspect of technological literacy, Collier-Reed (2008) asserts that for a person to be considered technologically literate, (s)he must "understand the nature of technology, have a hands-on capability and capacity to interact with technological artifacts, and…be able to think critically about issues related to technology" (p. 24). In a subsequent article, Ingerman and Collier-Reed (2010) highlight the notion of action within their conception of technological literacy. "We argue that 'doing' holds a central position in all aspects relating to both technology and technological literacy" (p. 2).

3.0 Towards an authentic, project-based learning approach to fostering technology literacy

3.1 Constructionism: A theory of learning for technology literacy

If "doing" is central to technological literacy, then leading schoolchildren towards greater levels of technological literacy requires a commitment to a theory of learning where doing is also central. Constructionism is a theory of learning that shares key concepts of the more familiar theory of constructivism.

Constructionism - the N word as opposed to the V word--shares constructivism's connotation of learning as "building knowledge structures" irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it is a sand castle on the beach or a theory of the universe (Papert & Harel, 1991, p. 1).

Whether learning is viewed through a constructivist or constructionist lens, children are seen as constructing meaning through personal experience; their worlds and bodies of knowledge are progressively shaped as they encounter new and interesting parts of their world. Learners outgrow their current worldviews as they gain deeper understandings about themselves and their environments.

Seymour Papert is largely credited with developing constructionism as a learning theory and he explicitly builds on the work of Jean Piaget who is widely considered the forefather of constructivism. Where Papert diverges from Piaget's work is largely around issues of intelligence and children. Piaget focuses on how children gradually distance themselves from artifacts and environments as they are increasingly able to "mentally

manipulate symbolic objects within a realm of hypothetical worlds" (Ackermann, 2002, p. 6). Papert, on the other hand, sees "becoming one with the phenomenon under study" (Ackermann, 2002, p. 8) as the key to learning. That is, learning is situated and is best approached by "diving into" situations. For Piaget, children are solitary explorers seeking to make order over the dynamic physical world; they do so by constructing mental artifacts that build on existing scaffolds. Papert views children as relational, preferring to be fully engaged with the physical world and enjoying demonstrating their understanding through artifacts rather than through recollection (Ackermann, 2002).

If schools are to seriously pursue the advancement of students' technological literacy, and if "doing" (i.e. having a hands-on capability and capacity to interact with technological artifacts) is central to technology and technological literacy, there is little doubt that constructionism is the theory of learning that needs to guide those endeavors.

Constructionism is a theory of learning that holds that "[c]hildren don't get ideas; they make ideas. Moreover, constructionism suggests that learners are particularly likely to make new ideas when they are actively engaged in making some type of external artifact…which they can reflect upon and share with others" (Kafai & Resnick, 1996, p. 1). Thus, if schools are to seriously pursue the advancement of students' technological literacy, and if "doing" (i.e. having a hands-on capability and capacity to interact with technological artifacts) is central to technology and technological literacy, there is little doubt that constructionism is the theory of learning to guide those endeavors.

Where constructionism is the theory of learning, one application of that theory is project-based learning (PBL). Definitions of project-based learning are varied. In a review of the research on project-based learning, Thomas offers five criteria that together define PBL:

1. PBL projects are central, not peripheral to the curriculum ("projects are the curriculum")

2. PBL projects are focused on questions or problems that "drive" students to encounter (and struggle with) the central concepts and principles of a discipline ("This is usually done with a 'driving question' (Blumenfeld et al., 1991) or an ill-defined problem (Stepien and Gallagher, 1993)").

3. Projects involve students in a constructive investigation ("in order to be considered as a PBL project, the central activities of the project must involve the transformation and

construction of knowledge (by definition: new understandings, new skills) on the part of students (Bereiter & Scardamalia, 1999)").

4. Projects are student-driven to some significant degree ("PBL projects incorporate a good deal more student autonomy, choice, unsupervised work time, and responsibility than traditional instruction and traditional projects.")

5. Projects are realistic, not school-like ("PBL incorporates real-life challenges where the focus is on authentic (not simulated) problems or questions and where solutions have the potential to be implemented.")

A growing body of research documents the effectiveness of project-based learning. More specifically, there is empirical evidence that computer-mediated project-based learning (CMPBL) leads to the attainment of goals perfectly consistent with constructivism and constructionism (Branch, 2005; Liu et al., 2006; MacGregor & Thomas, 2005; Quek et al., 2006, Wong, 2006). Mioduser and Betzer (2007) examined the contribution of project-based learning to high-achieving high school students' knowledge acquisition and problem-solving abilities. Using a quasi-experimental design, the researchers determined that compared to a control group (no PBL), the students in the classes where PBL was heavily integrated demonstrated significantly higher levels of essential learning skills: formal knowledge acquisition, technological knowledge, knowledge resources utilized, and design skills. The PBL students also exhibited a positive change in attitude towards technology and technological studies. In a study of middle school students' creation of multimedia mini-documentaries to learn about early 19th Century U.S. History, Hernandez-Ramos and De La Paz (2009) concluded that students in an intervention group (technology-assisted project-based learning) demonstrated greater knowledge gains after the unit than students in a control group (taught by more traditional methods).

3.2 Assessment and project-based learning

One of the common features of the varying definitions of PBL is authentic assessment. What makes an assessment authentic, of course, is subjective. At the most basic level, though, authentic assessments differ from traditional assessments, which "typically tend to audit performance and uncover what students do not know, rather than what they do know" (McDonald, 2008, p. 17). In addition, traditional assessments are snapshots of what students can (and cannot) recall at the time of the test and tend to disrupt learning. However, where "doing" is central to students gaining technological literacy, traditional assessments will not work; technological literacy must be assessed in ways that are more authentic.

To offer guidance to states in meeting the technology literacy goals of NCLB, Title II, Part D, the State Educational Technology Directors Association (SETDA) convened a workgroup on assessing technology literacy. Recognizing that the depth of assessment will vary according to the status of assessment requirements at the state or local level, that workgroup ultimately developed a continuum for assessment. Cognizant of the multidimensionality of technological literacy, the SETDA workgroup notes that a knowledge-based assessment is insufficient on its own. If such an assessment is used, it should be used as a base in combination with a performance-based, portfolio-based or project-based assessment. Also, notably, at the highest end of the continuum is project-based assessment.

Additionally, In 2003, the National Academy of Engineering (NAE) and the Board on Testing and Assessment at the Center for Education, part of the National Research Council (NRC) commissioned the Committee on Assessing Technological Literacy, a group of experts on diverse subjects. "The committee's charge was to determine the most viable approach or approaches to assessing technological literacy in U.S. K– 12 students, K– 12 teachers, and out-of-school adults" (p.2).

The Committee spent two years carrying out its commission and the work culminated in a report entitled *Tech Tally: Approaches to Assessing Technological Literacy* (Gamire & Pearson, 2006). To prepare that report, the committee consulted with many stakeholders and reviewed existing assessment instruments and

the literature on assessment, cognition, and technological literacy. Ultimately, the committee developed six principles guiding the development of assessments of technological literacy:

1. Assessments should be designed with a clear purpose in mind.
2. Assessment developers should take into account research findings related to how children and adults learn, including how they learn about technology.
3. The content of an assessment should be based on rigorously developed learning standards.
4. Assessments should provide information about all three dimensions of technological literacy— knowledge, capabilities, and critical thinking and decision making.
5. Assessments should not reflect gender, culture, or socioeconomic bias.
6. Assessments should be accessible to people with mental or physical disabilities.

Assessing technological literacy is extremely complex. "The most difficult dimension to assess is the capability (or doing) dimension, which includes design activities. This dimension simply cannot be fairly assessed via a paper-and-pencil test"

(Gamire & Pearson, 2006, p. 47).

Combining principles one and three from the *Tech Tally* list above, any good assessment of technological literacy should be driven by a clear operational definition of technological literacy and based on rigorous standards. Most assessments available beyond what is generated locally, especially those available commercially, meet at least the latter expectation. That is, their assessments are standards-based and almost always based on NETS-S.

Clearly, principal four presents the greatest challenge. Chief among the conclusions reached by the NAE/NRC committee is that assessing technological literacy is extremely complex because the three intertwined dimensions of technological literacy are not easily assessed. "The most difficult dimension to assess is the capability (or doing) dimension, which includes design activities. This dimension simply cannot be fairly assessed via a paper-and-pencil test" (Gamire & Pearson, 2006, p. 47).

Where *web-based* replaces *paper-and-pencil*, the issue remains. That is, moving the assessment to a digital platform presents some new possibilities, including, for example, adaptive assessment which adjusts based on student responses. However, it is still not possible to truly assess the capability (or doing) dimension of technological literacy on a computer- or web-based assessment. A web-based assessment could test a student's ability to perform certain routine tasks such as modifying a cell on a spreadsheet or

inserting an image into a presentation slide. While arguably a step forward, demonstrating a routine task is not the same as doing in the technological literacy sense. The capability (or doing) dimension includes design activities that can only be assessed more holistically. Again, in Collier-Reed's (2008) terms, for a person to be considered technologically literate, (s)he must "...have a hands-on capability and capacity to interact with technological artifacts" (p. 24). True project-based assessment is the only way to properly assess technological literacy.

True project-based assessment is the only way to properly assess technological literacy.

As a final point with respect to the NAE/NRC guidelines for assessing technological literacy, principle six might be easy to overlook. Many of the assessments being used by state and local education agencies to satisfy the Title II-D requirements are web-based. In a paper on large-scale assessment, Dolan and Hall (2001) conclude:

Ironically, current efforts to administer computer-based testing in many states may potentially decrease accessibility since they are largely done without considering student needs from the start. While merely offering tests in a digital format opens the doors to use of access tools such as text-to-speech, retrofit solutions are limited in their effectiveness; tests must be designed from the start to be inclusive of all students (p. 24).

Thus, before adopting any form of purely web-based assessment, state and local education agencies should take all necessary steps to ensure that there are no accessibility issues.

To sum up to this point, pursuant to federal law, all students should be technologically literate by 8th grade. While state and local education agencies have approached that expectation variably and while there are varying definitions of technology literacy, there is some consistency, including that "doing" is a central component. Furthermore, constructionism is a theory of learning by doing and project-based learning is an application of constructionism. PBL is an ideal match for fostering and assessing technological literacy because with true PBL, the project is the curriculum *and* the assessment. It is an outcome exactly at the intersection of knowledge, critical thinking/decision making, and capabilities. The project requires a student to apply knowledge and make critical decisions as (s)he demonstrates his/her capabilities. It is in this light that TechYES by Generation YES shines as an exemplary approach to the development and assessment of technological literacy.

4.0 Project-based learning and technology literacy: The Generation YES approach

A review of existing technology literacy models and assessment shows that TechYES by Generation YES shines as an exemplary approach to the development and assessment of technological literacy.

The TechYES technology literacy certification program, developed and implemented by the Generation YES Corporation using research-based practices, is designed to provide educators a way to allow students to participate in authentic, project-based learning activities that reflect essential technological literacies. The program was initially designed by a number of protégés of Seymour Papert, including Dennis Harper, Gary Stager, and David Thornburg. Intended for use with middle school students, TechYES may be implemented through integration into core content course work, as a supplement to the curriculum of a technology course, or as an after-school club activity. A well-considered peer-mentoring program assists the classroom teacher and provides leadership opportunities for students interested in technology or those who need an opportunity to become more involved in the learning community. Students are encouraged to select real-world problems of personal interest, and develop and complete two projects that meet state and local technology proficiency requirements in order to achieve TechYES certification. TechYES materials (individual student guidebooks, customized teacher/advisor materials, handouts and resources, access to a fully interactive support website, and certificates of completion) provide a framework to assist teachers in facilitation and students in completion of the projects.

The TechYES program not only provides an effective avenue to student technology literacy, but also provides an opportunity for schools to create an in-house cadre of student technology specialists who can work with teachers as well as other students. The peer-mentor training that is integral to the structure of TechYES, creates a pool of technology expertise that "can support any technology use in a school and provide teachers with training, support, and mentoring" that "employs best practices—embedded, on-site, and long-term—of professional development" (Wan, Ward, & Harper, 2010, p. 70).

The Verizon California Technology Literacy Project involved implementation of the TechYES program to over 10,000 7th grade students in schools in California's San Joaquin Valley. In an evaluation completed by the Woodside Research Consortium, Dr. Steven A. Schneider found that "there was a significant positive change in the knowledge and skills of all those involved in

TechYES" (Woodside Research Consultants, 2006, p. 6). Teachers/ advisors found growth in their own as well as their students' technology skills, and the development of students' leadership skills, particularly among the peer mentors. Overall, "advisors, peer mentors and students in the TechYES program agree that TechYES is a productive way to ensure that middle school students are technology literate and that TechYES is an effective strategy to bridge the digital divide" (Woodside Research Consultants, 2006, p. 7).

The State of New York used federal Title II Part D (EETT) funds to establish the New York Student Technology Leaders (NYSSTL) model in 45 rural districts in two BOCES (service centers) in the fall of 2008. Part of the NYSSTL model included all middle school students in these districts completing two TechYES projects to show technology literacy. During the 2008-09 school year, 2, 332 students completed two technology projects each and were certified technology literate. Twenty-four additional schools joined NYSSTL in the 2009-10 school year. An evaluation of the program concluded that the percentage of students achieving proficiency on statewide math tests increased across all participating schools over the course of the program. "This finding suggests that the certification process has created an environment of vigorous learning and that the TechYES initiative evokes an enthusiasm in learning that becomes cumulative over time" (Chapin, 2010, p. 3).

The TechYES program includes an excellent, authentic, project-based method for assessing student technology literacy and helps state and local education agencies satisfy the Title II, Part D expectations for technology literacy by the eighth grade. The program includes a research-based, performance-based assessment methodology that yields a proficiency score for students against all of the NETS-S performance indicators and standards. In order to attain TechYES certification, a student must have his/her projects assessed by both a trained student peer mentor and an adult teacher/advisor. Students present their projects and answer mentor/advisor questions. Responses are compiled using the TechYES online tools where a proficiency level

is assigned. These proficiency levels are aligned to the ISTE NETS•S standards and performance indicators using valid and proven algorithms. The program provides easy to read summary reports by student, school, or district. The reports give teachers and administrators a snapshot view of student achievement on the standards as well as links to the actual student projects (Generation YES, 2010).

TechYES provides schools a framework to build a technology literacy model for students that meets all six principles of the NAE/NRC criteria for technology literacy assessment. TechYES has a research-based design that builds on current learning theory and provides practical resources for teachers and students. TechYES provides students with valuable formative assessment as they work on real projects, giving students the opportunity to correct misunderstandings, gain new skills, and make decisions that lead to increased knowledge. Finally, since TechYES requires student-designed projects, they reflect student interests and abilities, decreasing gender, culture, and socioeconomic bias and opening up the process to students at varying ability levels

Education is a political domain and decisions about teaching and learning are, therefore, complicated. Where the goal is to help students simply improve their vocabulary, there are legitimate arguments for multiple modes of teaching and assessing that development. Good direct instruction might be just as effective as a more student-centered approach. Around a multidimensional construct such as technological literacy, where capabilities are central, students must actively engage in the doing; they must actually construct artifacts through project-based work using real tools for educators to be able to authentically assess student growth. TechYES enables students to learn how to learn and "do things" with new technologies to meet the challenges of becoming a technology literate person in the 21st century.

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ABOUT THE AUTHORS

Jonathan D. Becker, J.D., Ph.D.
After graduating *cum laude* from Duke University with a B.A. in Public Policy Studies in 1994, Jonathan Becker received a law degree and a masters degree in curriculum and instruction from Boston College Law School and the Boston College Graduate School of Education in 1997. Additionally, in May of 2003, Jonathan earned a Ph.D. in the Politics of Education from Teachers College, Columbia University. From September 2002 to August 2007, Jonathan was an assistant professor in the Department of Foundations, Leadership and Policy Studies in the School of Education and Allied Human Services at Hofstra University. Now as an assistant professor at the Educational Leadership Department at Virginia Commonwealth University, Jonathan is teaching courses in school law, the politics of education and educational research methods.   Prior to beginning his professorial career, Jonathan served as Research Director at Interactive, Inc., an educational research and consulting company. In his capacity at Interactive, Inc., Jonathan directed and was involved in a number of research projects focused mostly on the achievement and equity effects of educational technology. Framed largely as mixed-methods evaluation research, these studies ranged from small-scale studies of school-based programs to federally funded statewide evaluations. As a principal investigator in a federally-funded study, Jonathan pioneered the use of novel data collection techniques including the use of desktop monitoring software to gauge file activity on classroom-based computers. Currently, Jonathan is serving as the evaluator of a multi-million dollar, multi-year grant program funded by the U.S. Department of Education and is a co-investigator of an NSF-funded grant targeted at research and development of science curriculum modules for students in underserved areas.

Cherise A. Hodge, M.Ed. & Mary W. Sepelyak, M.Ed.
Cherise and Mary are doctoral candidates in the Department of Educational Leadership at Virginia Commonwealth University. They also serve as instructional technology coordinators. As such, they are responsible for the professional development and facilitation of technology integration in the K-12 setting. In addition, they have written technology standards and curriculum, created professional development and technology plans at both the individual school and district levels, and have presented at technology conferences at the state and national levels.