Assessing Deeper Learning:

A Survey of Performance Assessment and Mastery-Tracking Tools

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Executive Summary

Elementary and secondary education are shifting from print to digital, from flat to engaging content, from passive to active learning, and from age-based cohorts to individual progressions. Assessment is shifting from multiple-choice quizzes at the end of a unit of content to a dynamic embedded process that engages students simultaneously in learning and assessment of that learning.

At most schools, performance tasks supplement more traditional forms of teaching and learning—they extend and apply learning and provide a form of alternative assessment. However, there is a growing cadre of schools (most are part of Deeper Learning networks[1]) where the instructional program is a sequence of performance tasks. These schools recognize the value of performance assessment.

Performance assessments make new standards real, personalize learning and can serve as authentic gateways in competency-based systems. Performance assessments are often the best way to apply knowledge and skills, particularly those difficult to measure in traditional ways such as critical thinking, collaboration, effective communication and academic mindset.

Despite marked progress in the last year, the tools for creating and managing performance assessments and tracking student progress are still inadequate for teams creating next-generation learning environments. For example, newer products developed specifically to support performance assessment do not integrate with existing LMS.

An exemplary system would be a full learning management system (LMS) that is easily supported with related features such as projects, instructional materials, rubrics, automatic scoring and communication tools. Assessment tools, gradebooks and a robust portfolio would complete the toolset desired for a learning platform for performance assessment. Equally important in this system are the services that accompany such a toolset, including the initial implementation service, professional development, technology support, ongoing software updates, online user community and regular user conferences.

This report was developed for Envision Education and the members of the Deeper Learning Student Assessment Initiative (DLSAI) in order to investigate the state of the field and report on best practices, tools and resources.

The DLSAI is a collaborative partnership of organizations with a common mission to support and improve student assessment practice. Partners include Asia Society, ConnectEd, Envision Education and New Tech Network. There is a common interest within the DLSAI to find the tools and technology that make Deeper Learning student assessment systems efficient and effective for networks, districts, schools and teachers.

This paper's primary purpose is to inform the DLSAI about platforms and interoperable components that may complement or enhance their existing systems. The second purpose is to share performance assessment lessons and recommendations with schools and districts across the nation that are shifting to increasingly personalized, Deeper Learning environments. Recommendations reflect a wide variety of schools and varying uses of performance assessment.

This report begins by building the context around the need for performance assessment tools by situating the paper's goals inside broader shifts to Deeper Learning and the application of educational technology. The introduction also includes a review of performance assessment types as well as the role of technology platforms.

Barriers to better performance assessment include:

» The wide range of performance assessment and open-ended nature of the responses make it challenging to build generalizable capabilities;

» Several tools were developed for specific school networks and are not available outside the network;

» Some tools developed for specific-use cases use terminology and assume practices that may be a barrier to adoption in other cases;

» Attempts to add flexibility add many (often unintuitive) steps to construct a standards-based performance task; and

» There are no recognized standards or best practices in measuring non-cognitive variables (also called social emotional learning or habits of success).

Twelve key features identified as important by the DLSAI partners include interoperability, calibration of scores, a library of tasks, support for multiple revisions and collaboration, standards-based project rubrics, available professional development, reporting tools, customization, student portfolio development, an updated user experience and an affordable price tag.

Until recently, performance assessment and mastery tracking were categories deemed unattractive for investment, resulting in a gap between leading customer expectations and the few tools designed to serve this emerging niche. This situation can be rectified with a combination of direct investment, aggregated demand and advocacy.

The school networks that sponsored this paper and others interested in performance assessment will need to convince major donors to invest more, and/or they will need to gain the support of more districts and networks in coordinated market signaling to drive increased private investment and a new generation of more powerful tools.
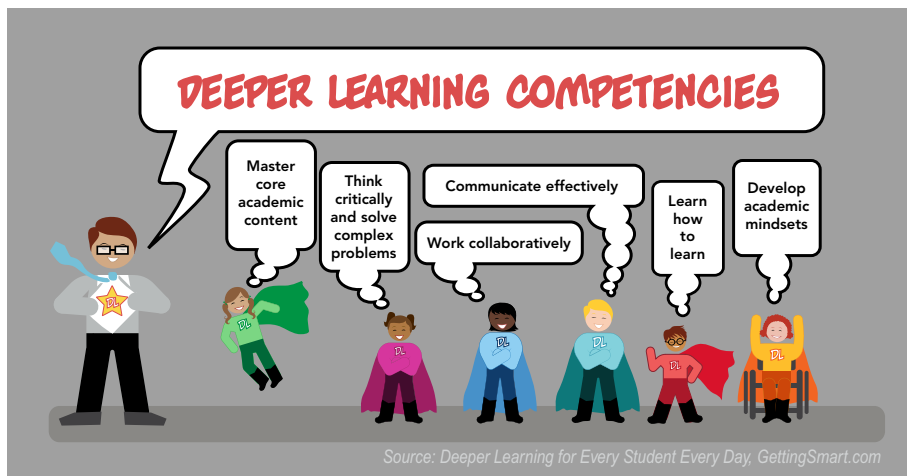
Introduction

Deeper Learning, as defined by the William and Flora Hewlett Foundation, involves the development of six key competencies:[2]

- » *Master core academic content*
- » *Think critically and solve complex problems*
- » *Work collaboratively*
- » *Communicate effectively*
- » *Learn how to learn*
- » *Develop academic mindsets*

For more information visit deeperlearning4all.org and download Deeper Learning for Every Student Every Day on GettingSmart.com.

The implementation of college- and career-ready standards and the next generation of student assessments has led to a once-in-a-generation opportunity to reevaluate the purpose of education and the meaning of the high school diploma. Schools and districts are reimagining teaching and learning. The result of this national vision exercise is that learning is starting to look different and students have a wider range of learning opportunities than ever. Trends such as blended learning and online learning that leverage technology are personalizing instruction in new and meaningful ways.

The calls for employees with a stronger work ethic, more initiative and better critical thinking skills from America's leading CEOs are echoed by trends such as Deeper Learning that aim to vastly improve the college and career readiness of high school graduates.[3] The readiness envisioned requires not only mastery of basic reading, writing and problem-solving skills, but also the ability to apply those skills, as a member of a diverse team, in a variety of settings.

DEEPER LEARNING COMPETENCIES

Master core academic content

Think critically and solve complex problems

Communicate effectively

Work collaboratively

Learn how to learn

Develop academic mindsets

Source: Deeper Learning for Every Student Every Day, GettingSmart.com

According to Suzie Boss of Edutopia, Deeper Learning starts with the fundamental question,

"In an era of rapid change, how can we prepare students for future careers and for being good citizens in a civil society?"[4]

Deeper Learning

Growing out of the need to improve the college and career readiness of high school graduates, schools across the country are creating opportunities to empower students to develop Deeper Learning competencies.[5] The schools vary by geography, student characteristics, size and mission but are uniform in their commitment to equip students with the necessary skills to thrive in the 21st century. Often this is characterized by inquiry-based learning that is contextual, creative and shared, with student collaboration on projects that require critical thinking and communication.[6] Schools that exhibit Deeper Learning**:**[7]

» Engage students in authentic interdisciplinary work that is often community-connected;
» Ask students to explore—and often solve—real problems faced by employers and community members;
» Ask students to produce and present professional quality work product to community audiences;
» Value employability and track work skills as well as academic progress.

Deeper Learning schools often harness the power of technology to personalize and customize learning. Experts contend that with the prevalence of affordable devices and a plethora of digital resources, Deeper Learning is now achievable at scale.[8] Schools in the Asia Society network use technology to create global collaboration opportunities and increase student engagement to promote Deeper Learning. Others embody the core values behind Deeper Learning in order to rethink and expand how and when learning takes place.

Deeper Learning involves the creation of opportunities to engage all students in order to develop the knowledge, skills and dispositions necessary to have viable life choices in the idea economy, and to boost civic engagement and participation. According to Tom Skjervheim of ConnectEd, a Linked Learning initiative, "Equity is at the heart. It involves starting at a place of clear expectations of where students need to be at graduation and the experiences to get there. The main goal is to get ALL students there."[9]

The Deeper Learning Student Assessment Initiative (DLSAI) *is a collaborative partnership of organizations with a common mission to support and improve student assessment practice. Identified as leaders in Deeper Learning and student assessment, Envision Learning Partners (ELP) provide leadership support for the DLSAI, which includes Asia Society, ConnectEd, Envision Education and New Tech Network. Through the partners' work within their networks and beyond, as well as the continued partnership with the Stanford Center for Assessment and Learning Equity (SCALE), the DLSAI is committed to expanding the reach of Deeper Learning and student assessment through the creation and sharing of tools and resources that aid in the effective implementation of performance tasks through the Deeper Learning Student Assessment System (DLSAS). There is a common interest within the DLSAI to find the tools and technology that make Deeper Learning student assessment systems efficient and effective for networks, districts, schools and teachers.*

Goals of the Paper

The Deeper Learning Student Assessment Initiative (DLSAI) partners believe in the Deeper Learning mission and their schools reflect the diversity of American secondary education—and the diversity of how they use performance assessment. Some schools use performance tasks to periodically check understanding while others have fully embraced project-based learning and use performance assessment every day within a culture of revision.

The DLSAI partners requested a scan of performance assessment tools and platforms. The primary purpose of the paper is to inform the partners and others interested in Deeper Learning about other platforms and interoperable components that may complement or enhance their existing systems. The second purpose is to share performance assessment lessons and recommendations with schools and districts across the nation. Recommendations reflect a wide variety of schools and varying uses of performance assessment.

A Description of the Deeper Learning Student Assessment System (DLSAS) *The DLSAS consists of performance tasks and rubrics that are closely aligned to the Common Core State Standards (CCSS) as well as the Deeper Learning Competencies. Its origins come from The Envision Graduate Portfolio and Defense System, which was built upon a vision of student assessment driven by portfolios and student defense of work and developed in partnership between Envision Learning Partners and the Stanford Center for Assessment, Learning, and Equality (SCALE) in 2003. After continued collaboration with SCALE, summer institutes, constant evaluation of student work and creation of common rubrics, "a credible and defensible assessment system" was formed. It is this student assessment system that attracted the organizations that later combined to form the DLSAI, and the partnership continues to work to support a meaningful, culminating experience for all students through the development, improvement, and implementation of this system.*

Performance Assessment

In the narrowest sense, according to Educational Testing Services (ETS), performance assessment is "a test in which the test taker actually demonstrates the skills the test is intended to measure by doing real-world tasks that require those skills, rather than by answering questions asking how to do them."[10] Many educators build on this basic definition and use the five criteria from Wiggins and McTighe in Understanding by Design (UbD) when creating and evaluating performance assessments: Real-World Goal, Role, Audience, Standards for Success and Product/Performance. Because it is a productive alternative to coverage and activity-oriented plans, UbD has become a widely used strategy of backward design of units and projects over the last decade.

In a personalized learning environment, as Barbara Bray explains, assessment becomes "as and for learning" and not so much about "of learning."[11] This sort of distinction is essential within the framework of Deeper Learning, where assessment is built into the process of learning and included structurally into the progression toward student mastery. It is in direct contrast to differentiated and individualized instruction in the traditional classroom, where assessment represents the end of learning and the discharge of assessment-specific accumulated knowledge. As ConnectEd's Tom Skjervheim says, "Give students a reason for why we are asking them to do what they do." In other words, create real-world experience with engagement while shifting away from testing as a driver and more toward performance assessment as the catalyst to learning.

Performance Task Features:[12]

» *Real-world scenario: students assume roles in real-world scenarios.*
» *Authentic, complex process: scenarios reflect complexity and ambiguity of real-world challenges.*
» *Higher-order thinking: requires critical thinking, analytic reasoning and problem solving.*
» *Authentic performance: the 'product' reflects what a professional would produce.*
» *Transparent evaluation criteria: the learning outcomes drive the creation of the task.*

Types of Performance Tasks

Project-based learning is the most common form of performance assessment. New tools are making it easier to investigate challenging topics, collaborate with people near and far, and produce high quality products. Schools that value Deeper Learning assign projects to students both as learning experiences and a form of assessment. Schools in the Asia Society, Big Picture Learning, EdVisions, Envision Education and New Tech Network provide examples of schools that, in addition to project-based learning, incorporate work- and community-based learning.

To avoid low level activities and promote Deeper Learning projects, High Tech High, Casco Bay, DSST, Odyssey and other top high schools suggest that it is helpful to:

» Pick compelling subjects: help students frame big but specific questions;

» Set rigorous goals: outline high quality products that will be produced and judged with standards-based rubrics;

» Make the projects long enough to go in depth; build in milestones to keep teams on track; and

» Ask students to publish their work and create venues for presentations of learning to the school community.[13]

There are many other forms of performance tasks: short and long constructed response, drawings and videos, and interviews. Technology enables production of quality products as well as complex engagements and simulations; it expands the number of ways that teachers can observe, share and assess student work.

In good performance assessments, students demonstrate understanding by applying what they have learned to solve new and challenging problems, but these are often summative assessments found towards the end of a course. The question is how to effectively prepare students to be successful on these very different types of performance assessment tasks.

Project Databases. *Asia Society's project database helps teachers to save time and share resources. Brandon Wiley, Executive Director of the International Studies Schools Network explains, "The goal is to encourage teachers to design quality performance assessments while also understanding teacher capacity and giving access to high quality projects that already exist." A key feature is a library of resources that can be easily searched and enables teachers to easily distinguish quality work.*

Gaming and Ongoing Assessment. *Game-based learning applications such as ST Math and DreamBox Learning provide examples of ongoing assessments embedded in practice. Matthew Peterson, co-founder and CTO of MIND Research explains, "By confronting all students with challenging interactive scenarios, where they have to extend and deepen their mathematical understanding to solve problems, ST Math embeds formative performance assessments throughout the learning process so that all students are familiar with solving problems using interactive virtual tools, and adept at using critical thinking to tackle novel problem solving situations." Tim Hudson, Director of Curriculum Design at DreamBox, states, "Some innovative game-based and adaptive learning programs embed key elements of performance assessment. These programs present students with new and unfamiliar situations that require them to engage in critical thinking and strategic problem solving to accomplish challenging and meaningful goals. "*

Technology Platforms and Performance Assessment

Technology-based formative assessment has improved significantly in the last three years. Standards-based quizzes can be quickly assembled and deployed to groups of students on mobile devices. Assessments are even embedded in games and adaptive learning systems.

However, tools that support performance assessment have not developed as quickly. Given the open-ended nature of performance tasks, they are more challenging to create and score. The time consuming challenges of assessment—creating and scoring standards-aligned projects, combining performance assessments with other forms of assessment, providing useful reports—continue because the toolset available to schools remains weak and undeveloped.

Despite a significant recent increase in education technology investment, it remains more difficult than it should be to create an effective sequence of learning experiences.[14] Underinvestment and weak demand articulation are two reasons why learning management and mastery-tracking systems have been slow to develop.[15]

Mastery-tracking tools capture assessment results in a standards-based gradebook and provide reporting tools for individual students and analysis tools for groups of students. Data visualization tools, like MasteryConnect's mastery tracker (below) provide useful summary level details.[16]

Badges (and other data visualization strategies) can be used to certify and celebrate achievement. They can also personalize learning by guiding choices on what to learn, how to learn and how to demonstrate learning. Badge systems are likely to become common matriculation management systems.[17]

Portfolio systems, like eduClipper and Pathbrite, create a running record of artifacts that reflect personal bests. ConnectEd Studios has created their own portfolio system that provides the opportunity for students to build an online gallery of their work and receive feedback from industry professionals. Portfolios are gaining post-secondary importance as an alternative market-signaling device that supplements or, with a badging system, replaces traditional degrees and certificates.

Well-constructed performance assessments and useful mastery-tracking tools can create high agency learning environments where students take responsibility for their own learning.

Source:
https://www.masteryconnect.com/learn-more/features.html
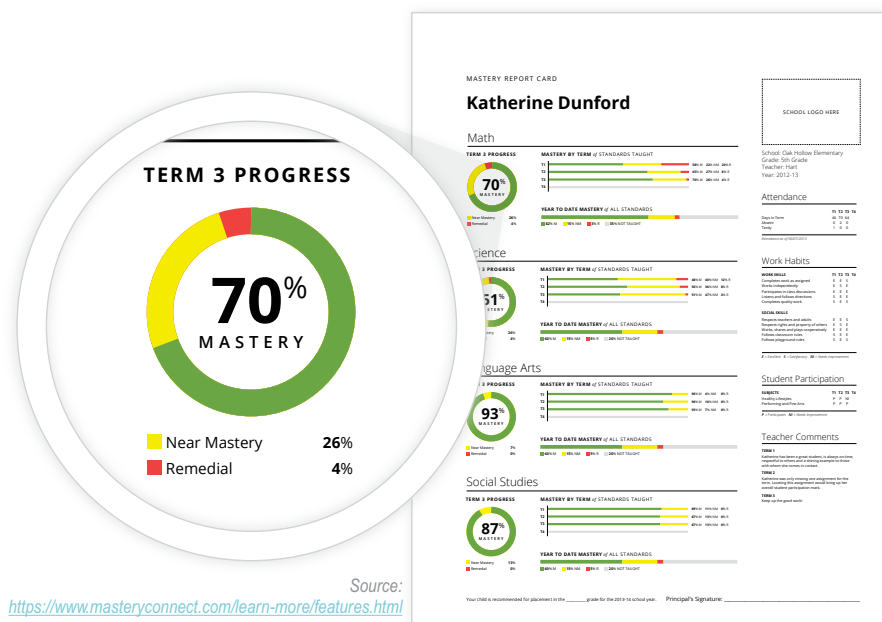
Sonny Magana, Marzano Research, says,

"When students use technology to chart their progress toward target learning goals, it prompts them to take an active role in understanding the learning target, processing their current level of achievement, and planning action steps."[18]
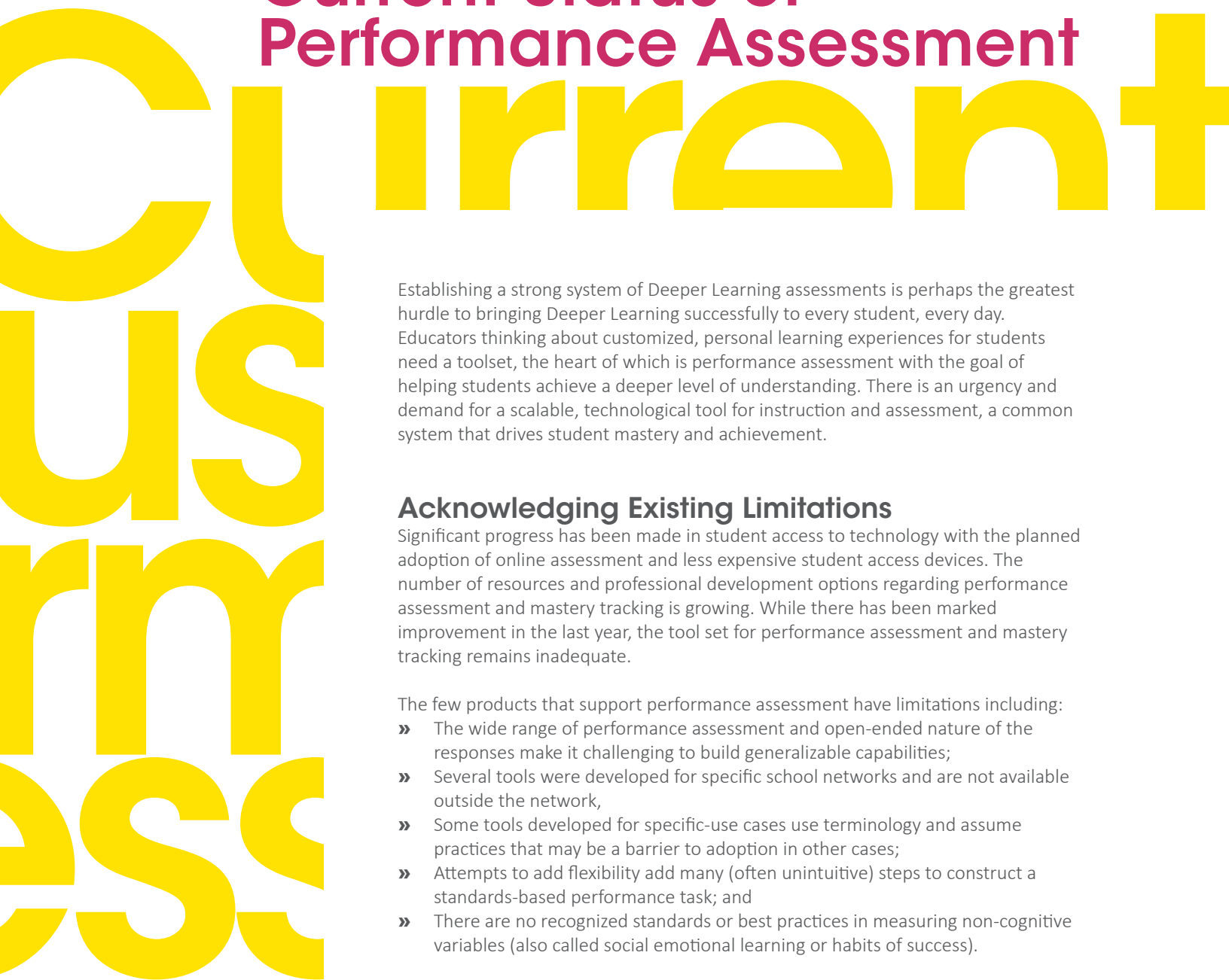
Current Status of Performance Assessment

Establishing a strong system of Deeper Learning assessments is perhaps the greatest hurdle to bringing Deeper Learning successfully to every student, every day. Educators thinking about customized, personal learning experiences for students need a toolset, the heart of which is performance assessment with the goal of helping students achieve a deeper level of understanding. There is an urgency and demand for a scalable, technological tool for instruction and assessment, a common system that drives student mastery and achievement.

Acknowledging Existing Limitations

Significant progress has been made in student access to technology with the planned adoption of online assessment and less expensive student access devices. The number of resources and professional development options regarding performance assessment and mastery tracking is growing. While there has been marked improvement in the last year, the tool set for performance assessment and mastery tracking remains inadequate.

The few products that support performance assessment have limitations including:

» The wide range of performance assessment and open-ended nature of the responses make it challenging to build generalizable capabilities;

» Several tools were developed for specific school networks and are not available outside the network,

» Some tools developed for specific-use cases use terminology and assume practices that may be a barrier to adoption in other cases;

» Attempts to add flexibility add many (often unintuitive) steps to construct a standards-based performance task; and

» There are no recognized standards or best practices in measuring non-cognitive variables (also called social emotional learning or habits of success).

A 2013 report by David Conley and Linda Darling-Hammond—"Creating Systems of Assessment for Deeper Learning"—advocates for new systems of assessment that support the development of Deeper Learning skills that combine traditional tests with classroom-based performance assessments. The authors contend that this "multiple measures" combination will yield both formative and summative student data and ultimately better inform students, parents, teachers, colleges and employers about student achievement. The report describes five major features of such a system: 1) Assessment of Higher-Order Cognitive Skills; 2) High-Fidelity Assessment of Critical Abilities; 3) Standards that are Internationally Benchmarked; 4) Use of Items that are Instructionally Sensitive and Educationally Valuable; and 5) Assessments that are Valid, Reliable, and Fair. The authors point to student-designed projects at Envision Schools as an example of assessments for Deeper Learning. The report's conclusions and recommendations provide a useful framework for the development of policies to support the creation of assessments that can accurately measure Deeper Learning and ensure college and career readiness.[19]

Defining Key Features & Future Needs

For those dedicated to and highly engaged in the work of Deeper Learning, and more specifically performance assessment, there is a high need for tools that support both the teacher and the student in the shift to Deeper Learning. Technology allows for consistency and efficiency across schools and networks. For groups that are interested in scalability and increased interaction among large groups, technology is key.

In order to build a support tool, the architecture must first be defined. This includes making decisions for matriculation management, evaluating content, teacher development and determining how these elements can be used in different learning environments. As

Justin Wells, Director of Client Partnerships at Envision Learning Partners explains, "What is ironic about all this is that conceptually it is all very complex; however, once it is accomplished, its expressions will be elegantly simple."[20]

In interviews, DLSAI partners identified 12 features key to supporting performance assessment. *(See Key Features of Performance Assessment Tools exhibit on page 10.)*

Ideally, all 12 features would be incorporated into a single learning management system. If not, performance assessment applications should integrate with 10 other components/services. *(See Key Learning Platform Features reference exhibit below.)*

Exhibit: Key Learning Platform Features

If not a full learning management platform, performance assessment tools must integrate with and be supported by 10 components/services:[21]

☑ *Tagged libraries of open and proprietary content (including projects) with search, content management and authoring tools;*

☑ *Social, collaborative and productivity tools;*

☑ *Formative assessment tools and achievement analytics;*

☑ *Comprehensive learner profiles and portfolio;*

☑ *Recommendation engines that build custom playlists;*

☑ *Feedback and reporting tools including achievement recognition systems such as badges or other micro credentialing strategies that support matriculation management;*

☑ *Student services: tutoring, guidance, health, youth and family services;*

☑ *Teacher services: professional development, lesson and tool sharing;*
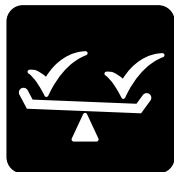
☑ *School services: implementation and tech support;*

☑ *Back-office services: enrollment, finance, and personnel.*
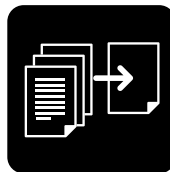
Exhibit: Key Features of Performance Assessment Tools

INTEROPERABILITY:
The capability of a platform to interact and exchange information with other software systems.

CALIBRATION:
Efforts to boost inter-rater reliability of assessment scoring including anchor papers, peer review, professional development and professional learning communities.

DATABASE OF PERFORMANCE TASKS:
A library of projects and scoring rubrics that can be searched and adapted; some include examples of quality student work.

REVISION AND FORMATIVE ASSESSMENT:
Ability to support student-teacher communication through the revision process and tracking assessment as learning rather than assessment for learning.

CUSTOMIZATION:
The ability of a platform to modify functionality and align to specific standards/rubrics to meet the needs of the schools, districts and networks.

COLLABORATION:
Allowing participants to interact with each other as well as the content, including best practice sharing and access to professional learning communities.
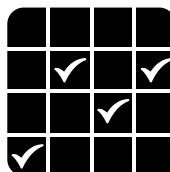
STANDARDS-BASED RUBRICS:
A record of progress against specific sub-skill standards with support for reporting on the progress of individual students and groups.

PD AVAILABLE:
Opportunities for teacher reflection and improved practice; in the context of performance assessment products, professional development includes product-specific training.

PORTFOLIO:
A collection of student work linked to learning standards.

REPORTING TOOLS:
Providing summary level information, sometimes using data visualization and analysis tools, to investigate the progress of individual students and groups of students.

USER EXPERIENCE/ USABILITY:
The teacher and student attitudes about, and response to, a product.

COST:
Product's cost model from free/open-source to freemium, a free teacher edition with a premium experience and/or enterprise version for the school or district level; to a per student, per teacher or per district fee.

Analysis of Existing Assessment Tools

There are four tools (not including network-specific tools) that attempt to meet most of the 12 key performance assessment features discussed above:

» Acuity: diagnostic K-12 assessment platform from CTB McGraw-Hill with 400 performance tasks and a performance task and rubric creation tool.[22]

» Project Foundry: project-based creation and assessment tool with workflow management and mastery-tracking features.

» Schoolnet: Pearson's instructional management system supports development and scoring of simple performance tasks.

» ShowEvidence: a comprehensive performance assessment system to create, assign, score and share performance tasks.

Acuity and Schoolnet are formative assessment platforms with some performance assessment features. They were designed for schools that make periodic use of performance assessment as a check on learning and are less well suited for project-based schools making performance tasks central to the instructional program.

Project Foundry, from Project-Based Learning Systems, was developed largely in support of the project-based Edvisions high school network. A recent merger provided a small infusion of capital, enabling an updated user experience, Google Drive integration, workflow management and an upcoming freemium classroom version.

ShowEvidence was built to support more effective performance assessment. With a grant from the Hewlett Foundation, a beta version of ShowEvidence was made available to DLSAI partners. The initial architecture was better suited for periodic use rather than continuous embedded use in a culture of revision common across DLSAI. Responding to user feedback, the second version better matched partner requirements (three of five product milestones in version two have been released, and full release, including a task authoring tool and the ability to upload a task from anywhere, is anticipated by April 2014). ShowEvidence is now used periodically by some schools and continuously by other schools.

There are many relatively new formative assessment tools. MasteryConnect and Naiku facilitate quiz and item sharing. They provide some support for performance tasks and computer-enhanced items, but most use is multiple choice. MasteryConnect supports large scale professional learning communities and has attractive and useful graphical reports.[23] Taskstream, although designed predominantly for higher education, is another tool that offers unique assessment and workflow management features as well as e-portfolio capabilities.

None of these formative assessment tools deal adequately with the subjectivity and inter-rater reliability associated with evaluating performance tasks. There are three primary ways of improving the reliability of scoring (discussed in more detail in Recommendations):

» *Anchor products:* scored examples of student work on the same or similar performance tasks;

» *Professional development:* online professional learning communities are a useful structure for comparing and discussing student work.[24]

» *Peer review:* the ability to have multiple teachers evaluating student work and comparing scoring for levels of agreement. ShowEvidence will introduce some automation of this comparison process in April. SWoRD Peer Assessment from Panther Learning attempts to extract peer review bias.

» *Automated scoring:* encouraging students to review automated feedback on early drafts can support more writing, improve the quality of final work product and build awareness of expectations. Automated scoring can also be used like peer review to corroborate final assessments.

Trends in formative assessment include mobile (e.g., For All Rubrics, Metryx, Nutmeg Education), quick checks (e.g., InfuseLearning[25], Socrative), and informal polling (e.g., TodaysMeet, Poll Everywhere).

Performance assessment tools are rated on the 12 key features on *(See Table 1 on pages 13-16).*

Analysis of Mastery-Tracking Tools

PowerTeacher is the most widely used gradebook. Combined with Schoolnet, it offers expanded assessment and reporting capabilities.

A new generation of gradebooks makes it easier to track standards-based achievement based on multiple assessments. Notable gradebook startups include Engrade, recently acquired by McGraw-Hill Education, JumpRope and Kickboard; they provide standards-based gradebooks, classroom management tools, multiple grading strategies and support for teacher-developed task rubrics.

Most current gradebooks fall short in six areas. They should:
» Fully capture desired and observed outcomes of performance tasks and projects;
» Easily (often automatically) collect observations from many assessment sources such as teacher observations, end of unit quizzes, games, adaptive learning, tutoring, etc.;
» Use data visualization strategies to motivate learning and inform the student-teacher-parent dialog;
» Support the instructional and management requirements of competency-based environments;
» Include or integrate with a portfolio; and
» Incorporate an updated user experience.

The table below represents an attempt to evaluate the current industry-leading vendors with specific platforms that support performance assessment. Using the 12 key features the DLSAI network partners identified as essential to performance assessment, the table shows what attributes each existing platform already has, where plans are in place for additions, and where there is room for growth.

The table illustrates that none of the current tools fully meet desired functionality in every category (much less the 10 key learning platform features). The vendors, on the left, are all currently being used in schools across the country, while the features, on the top, represent desired performance assessment functionality. Information regarding vendor service features came through company interviews, product demonstrations, third party reviews and website information.

Table 1: Key Features of Performance Assessment Tools

Company/Product	Description	Interoperability	Calibration	Database of Performance Tasks	Revision + Formative Assessment	Customization	Collaboration	Standards-Based Rubrics	PD Available	Portfolio	Reporting Tools	User Experience/Usability	Cost
PREFORMANCE ASSESSMENT TOOLS													
Acuity	CCSS aligned formative assessments used by more than 1000 districts.	●	◐	●	●	●	●	●	●	◐	●	●	$6.95/std
Project Foundry	Project-based creation and assessment tool with project management and mastery tracking features. Used by EdVisions schools.	●	◐	●	●	●	◐	●	●	●	●	●	$13/std +portfolio
ShowEvidence	Performance assessment system.	●	◐	●	●	●	◐	●	●	◐	●	●	fee per student or teacher
Schoolnet	Pearson's instructional management system, supports formative assessment, integrated with widely used PowerSchools SIS.	●	◐	●	●	●	◐	●	●	◐	●	◐	per student license

Key: ○ = does not have feature/capability   ◐ = future plans for including/in development   ● = currently has feature
Note that UX is scored as 1: functional UX 2: updated user experience.

Table 1: Key Features of Performance Assessment Tools (cont.)

Company/Product	Description	Interoperability	Calibration	Database of Performance Tasks	Revision + Formative Assessment	Customization	Collaboration	Standards-Based Rubrics	PD Available	Portfolio	Reporting Tools	User Experience/Usability	Cost
OTHER FORMATIVE ASSESSMENT TOOLS													
MasteryConnect	CCSS aligned assessment sharing site with mastery tracker.	●	◐	◐	◐	◐	●	●	◐	●	●	●	Free for teachers, $6/std enterprise
Naiku	Standards-based mobile formative assessment solution.	●	◐	◐	●	●	●	●	◐	●	●	●	Freemium
SparkWorks	Competency and cloud-based software for online and mobile adaptive learning.	●	○	●	○	●	◐	●	●	●	●	●	Freemium
Taskstream	Portfolio and data management system focused to support "outcomes-based assessment".	●	●	○	●	●	●	◐	●	●	●	●	$49/year teacher subscription

Key: ○ = does not have feature/capability   ◐ = future plans for including/in development   ● = currently has feature

Note that UX is scored as 1: functional UX 2: updated user experience.

Table 1: Key Features of Performance Assessment Tools (cont.)

Company/Product	Description	Interoperability	Calibration	Database of Performance Tasks	Revision + Formative Assessment	Customization	Collaboration	Standards-Based Rubrics	PD Available	Portfolio	Reporting Tools	User Experience/Usability	Cost
MASTERY TRACKING/GRADEBOOKS													
engrade	Gradebook with classroom management features.	●	◐	◐	●	●	●	●	◐	●	●	●	Freemium
JumpRope	Standards-based gradebook that allows multiple teacher input. Customizeable standards aligned rubrics and planning tools to backmap units and courses.	●	◐	○	○	●	●	●	●	◐	●	●	Freemium
Kickboard	Standards-based gradebook that stores teacher developed tasks and rubrics, captures student artifacts.	●	◐	○	◐	●	◐	●	◐	●	●	●	Freemium
Learning Mastery Gradebook for Canvas	Mastery based gradebook embedded alongside the traditional Canvas gradebook.	●	◐	○	○	●	●	●	●	●	●	●	Freemium
PowerTeacher	Classroom management system used by more than 500k teachers, integrates with PowerSchools SIS and Schoolnet.	●	◐	○	◐	○	○	●	●	○	●	◐	Available for Purchase

Key: ○ = does not have feature/capability   ◐ = future plans for including/in development   ● = currently has feature

Note that UX is scored as 1: functional UX 2: updated user experience.

Table 1: Key Features of Performance Assessment Tools (cont.)

Company/Product	Description	Interoperability	Calibration	Database of Performance Tasks	Revision + Formative Assessment	Customization	Collaboration	Standards-Based Rubrics	PD Available	Portfolio	Reporting Tools	User Experience/Usability	Cost
NETWORK SPECIFIC TOOLS													
Buzz by EAA	Scalable personal learning application. Student driven personalized learning plans with teacher data feedback.	◐	○	●	◐	●	◐	●	●	◐	●	●	Network Specific
ConnectEd Studio	CCSS aligned, formative assessment tool with portfolio and sharing tools.	●	◐	◐	●	◐	●	●	◐	●	◐	●	Network Specific
New Tech Network Echo	Learning management system including CCSS aligned formative assessments used by more than 1000 districts.	○	◐	●	●	●	◐	●	●	◐	●	●	Network Specific

Key: ○ = does not have feature/capability   ◐ = future plans for including/in development   ● = currently has feature
Note that UX is scored as 1: functional UX 2: updated user experience.

Considerations

Among schools and networks seeking performance assessment tools, there is growing demand and a strong sense of urgency to track mastery and achievement across the Deeper Learning competencies. This section acknowledges the three key considerations involved in decisions related to cost, market dynamics and interoperability.

Cost Analysis

There is a wide variation in cost in the continuum from free and open tools, to free products with premium features, to expensive district-wide subscriptions. In most situations, product cost falls into one of three categories:

» *Open-source:* free and open for reuse;
» *Freemium:* applications free for individual teachers with premium enterprise versions for school and district-wide use; and
» *Premium:* applications that charge per student, per school or district-wide license.

As the marketplace grows and more options become available, it will become increasingly important for vendors to showcase the value in their product. The more comprehensive a platform becomes, including the majority of factors from the table above, the easier it will be to justify cost. If schools and networks are forced to put together several components to support performance assessment, they will be more interested in open-source options.

For at least the rest of the decade, there were will be tension between mastery-based assessment and traditional grade-level proficiency measures. Paying for assessment and mastery platforms will help push the evolution of their quality and availability, but until there is a critical need to support this sort of system, progress will be slow.

Market Dynamics

A focus on standardized testing dampened investment in performance assessment over the last twenty years. However, the CCSS and the associated assessments funded by Race to the Top have renewed interest in more open-ended, performance-based tasks that build critical thinking and communication skills.

Until 2010 there was very little seed-stage and venture investment in education technology. Improvement in application development platforms and the introduction of mobile learning technologies led to an explosion of investment in the last three years. However, assessment investment has focused on easy-to-deploy and easy-to-score standards-based multiple-choice quizzes.

Innovations in learning, such as platforms that support performance assessment, are often out in front of the market and require an impact investor to provide a long runway. The most innovative work is underway from philanthropically supported teams developing new school models and platforms with private partners.

Interoperability

When schools and networks are looking to expand their reach, the issue of scalability is at the forefront of their thinking. Interoperability, or the capability of a platform to interact and engage with pre-existing software or systems, allows for information exchange and is a key to the logistics of helping networks expand and scale. Schools need the ability to share information and to interact meaningfully within professional learning communities. The goal is to get, and keep, everyone across the network connected with a system that offers continuity and consistency.

While a common platform can offer that capability, it is not the only solution. Rick Lear of New Tech Network explains, "One common platform may not be the only solution; we need some plugin that would work on different networks and systems, so there is place where student work can be loaded, evidence tagged, and anybody can score against a rubric and have their scoring recorded."[26]

Conclusions

Performance assessment is part of an approach to teaching and learning that values application over rote memorization. It involves complex challenges and high quality demonstrations of mastery. Unlike cycles of "memorize and regurgitate" that characterize thin test-prep instruction, performance tasks simultaneously engage students in learning experiences and assessment of that learning. This integrated, meaningful assessment is a necessary component in the development of Deeper Learning competencies, with the end result being high school graduates better equipped to thrive in college and career.

Despite trends that show more schools and networks are prioritizing the development of Deeper Learning competencies and looking for tools to measure them, many leaders in the shift to Deeper Learning find the current toolset limiting.
Creating learning environments that prepare students for college, careers and civic engagement by making extensive use of performance assessments remains a challenge. It requires a culture of high expectations, inquiry and collaboration; an appropriately broad set of outcome metrics; and thoughtful leadership.

The products designed to support performance assessment and mastery tracking are relatively new and are, in a number of respects, inadequate to the emerging demands of informed school networks. This product gap reflects a decade of under-investment in education technology platforms and tools that is only now beginning to be rectified by significant venture and philanthropic investment.

The gap also reflects changing uses of performance assessment from a periodic check of learning to an embedded element of learning experiences. Each of the school networks that sponsored this study make comprehensive and unique uses of performance assessment and use their own lexicon to describe tools and practices. Communicating common system requirements for these networks is challenging—doing so for the field is daunting. The lack of aggregated and articulated demand is a significant contributing factor to the limited number and weak feature set of existing tools.

U.S. education is in the early years of a historic shift to personalized and competency-based learning. The tools and schools that point the way are only beginning to emerge. The authors have written extensively about the and in this report identified key gaps in performance assessment and mastery-tracking tools. The authors have written extensively about the weak tools for next-generation models, and, in this report, have identified key gaps in performance assessment and mastery-tracking tools.

Recommendations

In addition to the conclusions presented above, this report ends with two primary recommendations to describe the need for more robust platforms and better implementation support. The recommendations encourage schools and networks to build on best practices and provide next steps for advancing the goals of the DLSAI.

Recommendation: More Robust Platforms

For-profit ventures exploit the most attractive market segments and avoid low margin and low growth categories. Until recently, performance assessment and mastery tracking were categories deemed unattractive for investment, resulting in a gap between leading customer expectations and the few tools designed to serve this emerging niche. This situation can be rectified in three ways:

» Direct investment by impact investors can result in breakthrough capabilities. For example, the Broad Foundation invested $10 million in Michigan's Education Achievement Authority to support an innovative school model and platform, and the Girard Foundation supported the development of Activate Instruction used by Summit Public Schools.
» Pull mechanisms including demand aggregation strategies and prizes can mobilize investment, leading to breakthrough capabilities. An aggressive impact investor may work both supply and demand, for example, investing in startup companies and supporting smart demand through a group like the Digital Promise League of Innovative Schools.
» Advocacy efforts that describe next-generation environments and tools and attempt to remove associated policy barriers can be helpful signs for investors and entrepreneurs.

Big companies as well as startups continue to build products for yesterday's school because they don't see a viable market for next-generation tools. To change that, the school networks that sponsored this paper and others interested in performance assessment will need to convince major donors to invest more and/or they will need to gain the support of more districts and networks in coordinated market signaling. For example, if schools representing several million students issued a request for tools that supported flexible and accurate performance assessment and comprehensive mastery tracking, it would attract attention and investment.

Recommendation: Better Implementation Support

This report is focused on tools and resources that promote consistently high quality performance assessment. However, implementation variables appear to be far more important than tools, especially given the nascent state of education technology. This section offers recommendations to schools and networks in the form of best practices and next steps.

Build on Best Practices

The following best practices can inform and inspire schools that are in the early stages of implementation. These best practices include descriptions of those leading the way in project-based learning, professional development, school culture, innovative school models and supportive district/state policy.

Well-Constructed Projects. Projects are widely used as high engagement instructional strategies, but they often vary in quality. Key to quality are helping students frame appropriate goals, building standards-based rubrics, and providing rigorous feedback and revision opportunities. Ron Berger of Expeditionary Learning advocates for continuous assessment in a project-based environment. Many teachers consider the final product the only form of assessment, but Berger says, "If the teacher isn't assessing all along the way then the final product will not show the high quality of success." He explains, "You don't want to undermine the quality of the final product by taking away the scaffolding, but you want a sense of their levels of understanding throughout that flow." Ron suggests building in on-demand assessment at multiple times before the final project, "Don't wait; check along the way."[27]

Teacher Capacity & Professional Development. Teacher development is probably the most important contributor to quality performance assessment. Each of the DLSAI network partners has a unique system of professional development to help support teachers in the use of performance assessment and the call to Deeper Learning. The similarities of these systems and the mission to support performance assessment and Deeper Learning unify the partners of the DLSAI. "In the same way that we need multiple measures

to assess student learning in classrooms, we need to broaden the assessments used to evaluate what teachers learn through professional development," said Bob Lenz of Envision Education.[28] With support from Hewlett Foundation, Envision is working with teachers in Alameda County, California. After a yearlong experience, teachers "show what they know" and present a final exhibition of learning.

As explained by Alexis Menten, Executive Director of Afterschool and Youth Leadership Initiatives with Asia Society, one of the challenges can be "supporting teachers who are new to the idea of performance assessment as well as to the technology that is aimed to support it."[29] The level of difficulty is often directed towards working within the tools and technology; however it is the paradigm shift in education that is often the root challenge. In order to assure that teachers are supported through this shift in pedagogy, each of the networks has specific systems that focus on how to support teachers in the development, implementation, scoring and evaluation of performance assessment. At Asia Society schools, professional development is done in a blended environment, some online and some offline. They use ShowEvidence to upload teacher professional development modules "so that the teachers can experience the platform as the students would see it."[30] These networks believe in supporting teachers to develop, implement, and analyze work. The goal is to help teachers understand how to use the rubric to grade effectively, as well as provide meaningful feedback to the students.

As Lenz describes, "Once a school or school system makes the move towards a Deeper Learning Student Assessment System, they need to consider the systemic impact of this move and the capacity that needs to be built for success at every level:"

Capacity building is required at every level:
- » *Students:* interventions and instructional strategies;
- » *Teachers:* support and professional development;
- » *Structures and Culture:* use of time, nature of relationships;
- » *Leadership:* learning agenda and support system for leaders.[31]

School Culture. Productive school cultures reinforce high expectations and an equity focus; they promote a commitment to inquiry and productive habits of mind, and they are reinforced by strong student supports.[32] Carmen Coleman has created a focus on powerful learning experiences in Danville, Kentucky. She knows that good schools start with good goals, which begins with powerful learning experiences for every student, every day. In a note to the staff at Bate Middle School, Coleman provided specific examples, including pictures, of what she appreciated, "Today, students in a fourth grade classroom couldn't wait to show me their new math journals. You should see them! The journals include space for the math standard, daily target, the student's proof of learning and reflection. In the reflection space, students are also challenged to prove their learning in a different, creative way. Awesome!"[33]

Many secondary schools that make productive use of performance assessments also have an advisory period. Most Expeditionary Learning schools start the day with a 30-minute advisory period, for example. And at Launch Expeditionary Learning Charter School in Brooklyn, the day begins with Crew, an advisory period where students practice and talk about the shared Habits of Heart and Mind central to the Launch culture: accountability, craftsmanship, wonder, mindfulness and compassion.[34]

New Tech Network schools "maintain a culture that promotes trust, respect, and responsibility." In high agency environments, New Tech students work on projects in teams similar to a professional work setting.[35] The New Tech School Success Rubric describes desired skills: "Students can design and manage complex tasks that reflect an authentic need or area of interest."[36]

National Academy Foundation published a useful guide to project-based learning, which points to a set of supporting classroom conditions including safe, respectful environments; personalized relationships; productive peer relationships; and transformed teacher roles. It also notes the importance of administrative support and time for professional collaboration.[37]

Valuable student learning experiences that result in quality work products are a result of high expectations and a commitment to inquiry, revision and collaboration—all a function of a productive school culture.

School Models. School structures, schedules, systems and staffing patterns can support or discourage quality performance assessment. A compartmentalized high school schedule with short periods is likely to discourage interdisciplinary projects, for example. The structure of the New Tech Network day and curriculum requires interdisciplinary inquiry, and the work is supported by a common project-based learning management system called Echo. EdVisions schools create space for extended projects and support the work on Project Foundry, a workflow management tool.

Each course at Summit Public Schools includes 100 hours of project time. Additionally, students participate in eight weeks of short interest-based expeditions. Scaffolding for students includes 16 hours of personalized learning each week at school and home. Teachers benefit from 40 days of professional learning every year.[38]

Expeditionary Learning schools stress big competency-based gateways, like year-end Passages projects. Other competency-based schools focus more on unit-based assessments to guide student progress.

District and State Policy. State testing systems influence the nature of classroom assessment. Adoption of the CCSS and the associated state tests has boosted interest in performance assessment as an instructional strategy that can promote Deeper Learning and greater skill transferability. Standards that stress effective communication and problem solving combined with tests that include a significant number of constructed response items appear to be increasing the use of performance assessments in many states.

The New England Secondary School Consortium (NESSC) is a project of the Great Schools Partnership in Connecticut, Maine, New Hampshire, Rhode Island and Vermont. They advocate for a seven-part definition of proficiency-based (called competency-based by iNACOL) learning; it provides a useful framework for the effective use of performance assessment:

» Students advance upon demonstration of mastery of content, 21st century skills, and dispositions that prepare them for college and careers;
» Learning standards are explicit, understood by students, and measurable;
» Assessments—formative, interim, and summative— measure and promote learning;

» Demonstration of learning uses a variety of assessment methods including in-depth performance assessments that expect application of learning;

» Instruction is personal, flexible and adaptable to students' needs, both initially and as required by ongoing student learning;

» Students both direct and lead their learning, even as they learn from and with others—both within and outside of schools; and

» Grading is used as a form of communication for students, parents and teachers—not control or punishment.[39]

As a matter of priorities, school districts/networks should encourage more writing and problem solving. Two examples include:

» *The projects at the heart of the instructional program at Summit Public Schools.* The Summit assessment plan says, "They are the assessments that frame our curriculum and define our courses, merging cognitive skill development with the most important content knowledge that students need to be prepared for college."

» *Multimedia plans at Mooresville Graded School District.* The district plans to implement four large-scale multimedia projects in 3rd, 6th, 8th and 12th grade. Students will add products from these projects to their digital portfolio. "A major project that a student has to struggle through is one of the best forms of assessment and leads to future success," said AASA national superintendent of the year Mark Edwards.

With the shift to competency-based policies it will become more common for schools to ask students to show what they know and for performance assessments to be combined with other forms of assessment to guide student matriculation.

Reliability. Performance assessment is more often valid than reliable. Validity refers to the accuracy of an assessment and whether or not it measures what it is supposed to measure. Reliability refers to the extent to which assessments are consistent.[40] A well-constructed project may have a standards-aligned rubric that ensures that the work is authentic and tests important knowledge and skills, but if different teachers score it inconsistently, the project lacks reliability as an assessment. Strategies to improve the consistency of performance assessments include:

» *Anchoring artifacts:* Scored examples of student work are the most common effort to calibrate scoring. To boost reliability, the Literacy Design Collaborative (LDC) worked with Stanford Center for Assessment, Learning, and Equity (SCALE) to develop a rubric to jury modules of performance tasks to ensure standards-alignment.[41] LDC resources also include a range of scored student work. The New York Department of Education has also released scored examples of student work.[42]

» *Double scoring:* Constructed response items on standardized summative assessments routinely use multiple scorers to improve score reliability. Danish schools use oral exams scored by a student's teacher as well as a teacher from another school to ensure scoring consistency. Panther Learning's SWoRD system attempts to extract the bias from peer review to boost inter-rater reliability.

» *Automated scoring:* Trained scoring engines have demonstrated the ability to effectively score constructed response tasks.[43] Automated scoring can be used to provide draft feedback supporting more writing assignments and more drafts.[44] Automated scoring can also be used like peer review to corroborate final assessments.

» *Professional learning communities (PLCs):* Building standards-based units and performance tasks can be an important step to internalizing expectations. Professional learning communities (PLCs) can provide an onsite and/or online opportunity to compare student work, share best practices and improve scoring consistency.

Next Steps

Schools and networks are in the earliest phases of the shift to increasingly personalized, Deeper Learning environments. This report offers an analysis of the existing tools for performance assessment as a starting point for a larger conversation that is only just beginning. The DLSAI initiated the conversation, and this report advances it by acknowledging existing limitations and defining key features needed to "move the needle" on performance assessment and mastery tracking. The conversation must continue and expand to include more schools, more providers and more stakeholders as all groups work together in service of students in the creation of a system that puts learners first.

Appendix A: Tools Related to Performance Assessment

This section identifies and categorizes tools and resources that support quality performance assessment.

Performance Assessment Tools
There are a limited number of tools that support the development and assessment of standards-aligned performance tasks. They include:
» Acuity: diagnostic K-12 assessment platform from CTB McGraw-Hill with 400 performance tasks and a performance task and rubric creation tool.[45]
» Empower: an upgraded version of the Educate LMS that allows for individual pacing expectations and student grouping management.
» Project Foundry: project-based creation and assessment tool with workflow management and mastery-tracking features.
» Schoolnet: Pearson's instructional management system supports development and scoring of simple performance tasks.
» ShowEvidence: a comprehensive performance assessment system to create, assign, score and share performance tasks.

Formative Assessment Tools
There is a growing number of web and mobile applications that support performance assessment including:
» *Formative assessment:* MasteryConnect, Naiku, SparkWorks, Taskstream
» *Mobile formative:* For All Rubrics, Metryx, Nutmeg Education
» *Quick checks:* InfuseLearning[46], Socrative
» *Informal polling:* TodaysMeet, Poll Everywhere

Network-Specific Platforms With Performance Assessment Features
There are three notable learning management platforms with performance assessment capabilities:
» New Tech Network Echo: a project-based learning management system used by more than 130 schools in the New Tech Network.[47]
» ConnectED Studios supports project-based learning for the Linked Learning network.
» Education Achievement Authority Buzz (developed on Agilix Brainhoney) is used by 15 schools in Detroit.[48]

Mastery Tracking
A new generation of gradebooks makes it easier to track standards-based achievement based on multiple assessments. Notable gradebooks include:
» Engrade is a widely used standards-based gradebook with assessment item authoring tools and a variety of class management features.[49] Engrade was acquired by McGraw-Hill Education in February.
» JumpRope is a standards-based gradebook that allows multiple teacher input. Teachers can customize standards-aligned rubrics and use planning tools to backmap units and courses.[50]
» Kickboard is a standards-based gradebook that stores teacher-developed tasks and rubrics, as well as captures student artifacts. Teachers can form and manage flexible groups and can identify how assessments are weighted towards mastery. Multiple grading formulas are available.[51]
» LearnBoost is a free gradebook with full Google apps integration that helps teachers create Common Core-aligned lessons; it is owned by Automattic (WordPress).
» MasteryConnect is an online assessment sharing community with a visually appealing mastery tracker.[52]
» PowerSchool is the most widely used student information system; PowerTeacher is the standards-based gradebook that syncs with Schoolnet assessment and reporting capabilities.
» School Loop is a gradebook and student tracker with parent communication features.

There are dozens of learning management systems with some formative assessment and mastery-tracking capabilities.

Portfolio Systems

It is becoming much easier to help students capture a running record of personal bests. Applications include:
» eduClipper is a K-12 system for pinning evidence to standards.[53]
» Pathbrite is a K-20 portfolio system.[54]
» ConnectEd Studios portfolios student work and connects students to industry professionals.
» DIGI[cation] is a K-20 portfolio system.
» OpenSchool ePortfolio has a project and rubric creator as well as a portfolio system.
» Three Ring manages student artifacts.[55]
» SchoolTube captures student-created video.
» TouchCast is a container for digital media.
» Google Drive is gaining use as a portfolio system.[56]

Production & Presentation Tools

There has been an explosion of web and mobile applications that support production and presentation of written and visual products including:
» *Essay:* Word, Google Drive, iAuthor (more word processing tools below)
» *Blogging:* Kidblog, Edublogs, Grammarly, WordPress
» *Presentation:* PowerPoint, Google Presentations, Prezi, Glogster, Smore, Haiku Deck, Tellagami
» *Coding[57]:* Code.org, Codecademy; CodeHS, Treehouse
» *Video editing:* iMovie, WeVideo, YouTube editor, VideoScribe, TouchCast
» *Recording tools:* Audioboo, Soundcloud, Google Voice
» *Collaborative production:* RealTimeBoard, Padlet, Google Drive, Oppia

English Language Arts (ELA)

There are dozens of mobile applications that support better writing.[58] Most notable are:
» NoRedInk is a fun way to practice and master grammar on content of interest. An adaptive engine shows tutorials that help students correct mistakes.
» StudySync uses video of student discourse to model careful reading, critical thinking and use of evidence—great examples of Common Core literacy.
» Whipsmart Learning, a developer of online literacy tools, is worth watching.
» StoryBird is a collaborative illustrated storytelling app for families.
» Evernote makes it easy for students to take notes on any device—laptops, tablets, smartphones. Students can also capture audio and photos. Photos of notes or written text can even be searchable within Evernote.

An emerging performance assessment category in ELA is automated essay scoring (AES) tools. Peter Foltz, from Pearson, said, "Across a series of studies, what we've shown is that when students get that instant feedback, and then revise their essays and resubmit them, we see gains not only in the quality of writing but also in their content learning."[59]

Beyond basic production tools, 14 comprehensive writing platforms were identified that provide ideation, drafting, grammar and editing support, as well as multi-trait feedback:
» Criterion Online Writing Evaluation service from ETS is a web-based instructional tool that teachers use with students to help them plan, write and revise essays, guided by instant annotated diagnostic feedback and a holistic score. Riverside Publishing, a division of HMH, distributes Criterion.
» Essay Punch from Merit Software contains nine writing topics and 1,080 help prompts to guide students through each step in the writing process with contextual help and feedback. Designed for students in grades seven to adult.

- » GradeMark from iParadigms (Turnitin) provides rich feedback to students by enabling editorial highlights, custom comments and QuickMark® editing marks directly on student papers. Turnitin runs the ETS e-rater grammar analysis tool within an updated user experience.[60]
- » Learning Oasis from Metametric provides differentiated reading, writing, and vocabulary activities. Learning Oasis leverages the power of the Lexile Frameworks for reading and writing to provide each individual student with appropriately challenging activities. The product is beta and not widely available.
- » Project Essay Grade (PEG) from Measurement Incorporated has provided over two million scores to students over the past five years. PEG powers NC Write, an online practice tool for North Carolina schools. More than 1,000 schools are using it as a formative writing assessment.
- » SAGrader improves student learning by providing immediate feedback on their content area writing. Perfect for knowledge-based writing in high school and college courses like biology, psychology and history.
- » Writing Roadmap from CTB is an online writing tool that provides an effective way for students to practice and improve their writing and for teachers to measure and track writing proficiency for students in Grades 3-12.
- » WriteToLearn from Pearson provides flexible, easy-to-use, effective writing assessment and instruction with added content and tools for English Language Learners. WriteToLearn is used statewide in South Dakota. MyWritingLab is a post-secondary platform powered by the same scoring engine.
- » MyAccess! from Vantage Learning has 1,300 writing topics in math, science, language arts and social studies with a fun, interactive (middle school targeted) interface that transforms writing instruction and assessment by providing immediate feedback. Vantage powers the spell and grammar check in Microsoft Word.
- » CRASE from Pacific Metrics, provides immediate, accurate and low-cost scoring of short-answer and essay items with six-trait feedback.
- » Writing Reviser from SAS helps students ask questions experienced writers ask automatically, from big picture issues to smaller details to enhance writing skills.
- » Odyssey Writer by Compass Learning is a customizable writing program for elementary and middle school students. Odyssey Writer can guide students through the entire writing process and make writing more focused, more effective and even more enjoyable. While some users think of Odyssey Writer as a word processor, this is only a portion of its use.
- » Lightside is a scoring and feedback platform developed at Carnegie Mellon University. The startup is working with a limited number of pilot sites.

Peer review tools may also become important in ELA-based on work done at Carnegie Mellon; Panther Learning has a peer review system that extracts bias from reviews.

Mathematics
There are a growing number of web resources for problem/project-based math including:
- » Mathalicious is a library of K-12 Common Core-aligned math lessons.
- » ST Math[61] is a visual game-based approach recognized for boosting proficiency in K-8 math.
- » Curriki Geometry[62] is a library of Common Core-aligned geometry projects including an online community component for teachers.
- » Exemplars offers K-12 Common Core-aligned open-ended math problems and related resources.
- » NASA Education provides K-12 and postsecondary teaching materials for project- and problem-based learning.
- » Lego Education has resources, from basics to robotics, that encourage critical thinking and problem solving with associated professional development, competition opportunities and collaborative online communities.
- » NYC Department of Education has a large library of tasks, units and student work organized by grade level and content.

Progress is being made on creating and grading innovative and open-ended math questions. Four new or updated applications include:
- » Maple TA is a web application for creating and scoring math assessments; it supports complex, free-form entry of

mathematical equations and intelligent evaluation of responses.

» ForefrontMath is a web application for creating math, sharing assessments and tracking student progress.
» Gradians is an online math grading site; reviewers provide detailed feedback to students.
» Blue Ribbon Testing has innovative (but not open-ended) math items.

Lesson Sharing

In the last three years, it has become much easier for teachers to share and find high quality lessons and performance assessment resources. Apps for pinning resources and sharing lessons include[63]:

» *Pinning resources:* MasteryConnect[64], EduClipper[65], Learni.st, Pinterest
» *Sharing lessons:* BetterLesson, ShareMyLesson, Teachers Pay Teachers, TED-Ed, ShowMe[66]
» *Project resources:* 8 Essential Elements and Project Design Rubric from Buck Institute; Literacy Design Collaborative has a library of performance tasks; ASCD's EduCore is a library of tasks with associated tools.

Project-Based Professional Development

There is expanding access to online and blended project-based learning: Buck Institute, Marzano Research Laboratory, Solution Tree and LearnZillion.

Appendix B: DLSAI Partners

Asia Society's International Studies Schools Network (ISSN) is a national network of design-driven public, charter and private schools committed to developing college-ready, globally competent graduates. The ISSN works with school communities to prepare students for work and civic roles in a globalized environment, where success increasingly requires Deeper Learning skills such as collaboration, critical thinking and teamwork. The ISSN has worked particularly hard to overcome chronic poor performance among low-income and minority students.
Network Profile

Linked Learning is an approach that uses "pathways" to help students of all abilities connect learning to their interests and career goals. A pathway spans grades nine to twelve, connects high school and postsecondary institutions to ensure a smooth transition after graduation, and integrates rigorous academic instruction with demanding technical curriculum and field-based learning. Pathways are developed around industry sectors, such as business and finance, building and environmental design, biomedical and health sciences, or arts, media, and entertainment.
Network Profile

Envision Education's curriculum and model utilize a "Know, Do, Reflect" approach to ensure that students excel at the Deeper Learning skills of thinking critically, collaborating productively, and communicating clearly. At Envision's three small, urban public schools in the San Francisco Bay Area, students learn not only to master academic content (to "know"), but also how to apply that knowledge to real-world solutions (to "do"). Throughout the process of acquiring knowledge, they discuss and analyze how they are learning (to "reflect").
Full Network Profile

New Tech Network is a nonprofit school development organization dedicated to ensuring that all students develop the skills and acquire the knowledge necessary to thrive in post-secondary education, careers, and civic life. Working with districts to build and sustain innovative K-12 public schools, New Tech Network creates a rigorous and engaging school experience that features the intensive use of Project-Based Learning and technology and establishes a positive and engaging school culture. In the seventeen years since its founding the Network has grown to 133 K-12 schools in twenty-three states and Australia.
Full Network Profile

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End Notes

1. For a list of innovative schools and Deeper Learning networks, see http://gettingsmart.com/2013/08/smart-list-10-innovative-high-schools-10-deeper-learning-networks.
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