Including Student Performance Data
in the
MN Digital Curriculum Catalog

A report of the Minnesota Online Learning Advisory Council
2010-2013

This report is in response to the legislative requirement enacted in 2012 in MN Statute 124D.095, Subdivision 10, paragraph (b), clause (2) for the Online (now Digital) Learning Advisory Council:

(b) By June 30, 2013, the Online Learning Advisory Council with the support of the Minnesota Department of Education and the Minnesota Learning Commons shall:

(1) oversee the development and maintenance of a catalog of publicly available digital learning content currently aligned to Minnesota academic standards to include:

(i) indexing of Minnesota academic standards with which curriculum is aligned;

(ii) a method for student and teacher users to provide evaluative feedback; and

(iii) a plan for ongoing maintenance; and

(2) recommend methods for including student performance data on the digital learning content within the catalog.

June 30, 2013

Acknowledgements

In 2010, 12 members from across the state were appointed to the K-12 Online Learning Advisory Council for a three year term to bring to the attention of the commissioner any matters related to online learning and provide input to the department.

The statute was revised in 2012 with additional tasks for the council. This included oversight of the development and maintenance of a catalog of publicly available digital learning content aligned to Minnesota academic standards and a request to **recommend methods for including student performance data on the digital learning content within the catalog.**

The council met 4-5 times each year over three years and addressed various tasks in focused discussion, expert testimony and through subcommittee work on specific issues. It is with deep appreciation that the council members are acknowledged. Their contributions, time and expertise were invaluable in the process of considering and constructing recommendations to state policymakers and the commissioner. Because the report is a consolidation of views and recommendations based on research and discussion with a range of stakeholders, the recommendations cannot be considered to represent the specific views of any individual council member.

K-12 Online Learning Advisory Council Members

- Stacy Bender, Dean of Students, Minnesota Virtual High School
- Gigi Dobosenski, Co-Director and Advisor, EdVisions Off Campus High School
- Karen Johnson, Director of SOCRATES Online, South Central Service Cooperative
- Dr. Gary Langer, Associate Vice Chancellor for Academic Innovations, Minnesota State Colleges and Universities
- Mary Mehsikomer, Technology Integration Development & Outreach Facilitator, TIES
- Elissa Raffa, Dean of Academic Programming, Minnesota Online High School
- Cecelia Retelle, Manager, Minnesota Chamber of Commerce (through September 2011)
- Curt Tryggestad, Superintendent, Eden Prairie Public Schools (formerly of Little Falls)
- Dr. Jonathan Voss, Supervisor of Academic Programs, Intermediate District 287
- John Weisser, Director of Technology, Bloomington Public Schools
- Dr. Jessica Wiley, Director of Educational Services, Northeast Metro 916 Intermediate School District

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Executive summary

It is the recommendation of the Minnesota Online Advisory Council that digital learning items within the Minnesota Digital Curriculum Catalog over time be required to include:

1. Competency-based goals that provide clear indicators of what students will be able to know and do after completing the activities of the unit or course, including:
    a. Depth of knowledge and level of mastery based on Bloom's revised digital taxonomy
    b. Types of competencies (content and cross-cutting)
    c. Level of thinking skills (higher or lower)
2. Performance assessments by which to show these outcomes:
    a. Various types of assessment that provide real-time data on performance, indicate the level of mastery attained and how achievement is measured;
    b. Summary data that can be included in the catalog to indicate ongoing performance of students using the resource.

As data is collected from the performance assessments on how students have demonstrated their achievement of the learning goals, analysis of the effectiveness of instructional elements will emerge.

Establishing a system to incorporate performance data of any kind will require a significant investment of resources. It is the opinion of the Council based on the research into performance data, that state testing data or other point-in-time summative assessment data could not be collected and referenced to these digital resources in a meaningful enough way to justify the potential expense. Likewise, growth indicators provided by pre and post testing may offer some valuable indicators for individual resources, yet uncertainties in the the environments in which these are administered would inhibit their reliability, and the cost of aligning them to standards would also be prohibitive. Moving toward a comprehensive system of articulating competencies and the performance-based assessments to measure them would provide the greatest return on the investment of time and money that would be necessary to implement ANY of the types of performance data under review.

Introduction: The MN Digital Curriculum Catalog and its content

Under the direction of the Online Advisory Council, a catalog of digital resources has been developed to include digital content aligned to Minnesota Academic Standards (https://mnlearningcommons.us/app/custom/MDE/home). The Minnesota Digital Curriculum Catalog (hereafter referred to as the "catalog") allows users to search for digital content that claims alignment to Minnesota academic standards. In its earliest stages, the content is not reviewed for verification of alignment. Created with legislative direction as stated above, the Minnesota Department of Education oversees the catalog with the advice and support of the Minnesota Learning Commons and the state's Online Learning Advisory Council. Additional features and review elements will be incorporated as the collection grows. Educators in Minnesota are invited to view and use existing resources and are encouraged to help build the inventory of public resources by becoming contributing members. Members and users of the resources will assist the Minnesota Department of Education in evaluating the quality of the resources submitted to the collection. As the collection of linked resources grows, peer review teams will be provided with tools and processes to review the quality of materials submitted to the catalog.

The resources within the catalog are intended to support Minnesota teachers in aligning their instruction with Minnesota standards while increasing the efficiency, individualization and scope of their instruction by using digital content from a wide variety of sources. Materials that are include in the catalog meet the following criteria:

1. Indicate alignment to Minnesota Academic Standards
2. Openly available in digital format

Resources are organized by:

1. Type: Activity, Lesson, Unit, or Course
2. Grade Levels: K-12
3. Subject area: English/Language Arts, Mathematics, Science, Social studies, and Electives

Within each subject area, the individual standards met by the catalog item are identified at the most useful level of organization. Teachers are able to search by standard and also by keywords to target their lesson planning to those resources most appropriate to their students' learning goals.

A primary goal of the catalog is to reduce the amount of time teachers need to find high quality resources. As the volume of information and materials available on the Internet has grown dramatically in the last several years, a common complaint from teachers is that they are overwhelmed in trying to find truly useful materials. Sifting through countless files of text documents, spreadsheets, pictures and slide show presentations, plus the exploding number of instructional videos and interactive activities, to find those that meet their specific lesson-planning needs can be as time-consuming as creating new materials. Therefore the catalog also provides a means of rating the resources by those who use them. Over time, the feedback from users will help guide teachers toward those resources deemed most valuable by other teachers.

In order to take advantage of the wealth of existing materials, the catalog does not itself contain instructional resources. Designed as a referatory rather than a repository, the catalog directs users to resources that already exist. Hence it is not within the purview of the catalog to design or create instructional materials. While there may be recommended elements and features that will emerge from the growth of catalog entries, in the initial stages it is not intended to manage content, but to share information on the content that exists. As an open resource venue, users are empowered to find, share, use, download, revise and remix elements of the resources within their own learning management systems and for their own purposes. As a result, the managers of the catalog have no direct access to tracking how the materials are used, or even if they are used once they are located. Later phases of development will include survey instruments to request feedback from users on how they used a particular resource. Even when feedback mechanisms are deployed, however, the results will be dependant on the users to provide. Any conclusions drawn from user feedback will need to be carefully considered in this context. Student performance data will not automatically be available from users who adopt any of the resources in the content.

As the catalog emerges, it could become the catalyst for a much wider range of content development and sharing. The Open Educational Resource movement has gained momentum in Minnesota and around the country, aimed at providing educators with high quality digital resources at vastly reduced costs. Proposals for reviewing content more deliberately have been presented by the Online Learning Advisory Council, the Minnesota Department of Education, and a variety of other organizations interested in improving and assuring the academic reliability and the instructional integrity of digital content. A set of standards for open resources is being considered as a means for assessing and evaluating content in the catalog. Efforts to collect open resources into course content bundles have also been launched, allowing districts to compare all available options in their curriculum review cycles. While these initiatives have grown independently of the catalog project, having a central location for referring education professionals to digital materials will prove extremely valuable as digital curriculum becomes the norm in all schools.

Types of student performance data

In determining how best to incorporate student performance data into the information in the catalog of digital resources, it will be important to identify the primary types of performance data that would be available, and would be most helpful for teachers in deciding whether to include a particular resource into their lesson planning. The terms “performance” and “achievement” are viewed very differently by various stakeholders, and so it will be imperative to define the performance that is to be expected, both in the resources and in the evaluation methods that are adopted. At the heart of the question is the concept and framework of **assessment** that underlies any instructional resources in the catalog. The movement to base quality assurance and accountability of schools on outcomes has led to a wide-ranging debate on the importance and types of assessment that should be used for measuring success.[1] This report is not

intended to provide an exhaustive review of the research and opinions on types of assessment. Rather it will focus only on the assessment types that lend themselves to producing data that could be made available to potential users of the resources in the catalog. In analyzing quality metrics for online learning at the program or school level, the International Association for K-12 Online Learning (iNACOL) identified 5 key elements:[2]

- Proficiency
- Individual student growth
- Graduation rate
- College and career readiness
- Closing the achievement gap

The first two of these, Proficiency and Growth, could also be applied to individual resources, be they units or courses. The last three apply more to the comprehensive experience of students over time, and could not be readily used to gauge the impact of an individual learning resource. Beyond these measures, iNACOL has also examined the impact of a trend that is at the forefront of many innovative reform efforts: competency-based learning. As the competency-based framework emerges as the optimal means for transforming education, particularly in regard to the impact of digital learning, it is imperative to consider how competency-based measures of quality for instructional resources might be included in the catalog.

Therefore the types of performance data which will be examined for their potential inclusion in the digital curriculum catalog include:

1. Proficiency: as measured by summative test scores (end of unit exam or state test)
2. Growth: as measured by pre and post assessments
3. Levels of competency/mastery achieved: as measured by performance-based assessments

Each of these types will be reviewed in terms of:

- availability of the data to the catalog
- alignment of the data to the use of a resource
- usefulness of the data to a teacher deciding on using a resource

The review will conclude with considerations of the *Outlook* for implementation and *Recommendations* for pursuing inclusion of this type of data.

1. Proficiency on point-in-time summative tests (state tests, end of course exams)

This is perhaps the most common question regarding digital resources or online courses: How will students who use this to learn the content do on the state tests? Will it hurt our school's or district's scores, or help them? With the emphasis on test scores from the Minnesota Comprehensive Assessments (MCA) for accountability of schools and districts, and now of administrators and teachers, this is a fair question, although limited in its impact on the broad scope of student learning goals. To what extent could data from state tests be disaggregated in such a way as to evaluate a resource based on the results students have had in using that resource?

In order to assign such test result data, it would first be necessary to carefully identify the standards that a particular unit or course is designed to meet. This is in fact a key element of the catalog--items that are included are expected to be aligned to MN Academic Standards, and to list those standards in the catalog entry. Next, it would be necessary to disaggregate the state testing data into the standards or other key skill areas that could be linked to the catalog resources. In order to match with the standard information in the catalog, these results would need to be aligned with standards in such a way that a clear mapping could be made between the standards a resource intends to meet, and the test results specifically targeted to measuring those skills. Careful attention to the details in mapping would be necessary in order for the data to correlate effectively. Different resources that met similar but not exactly the same standards or skills would be be difficult to compare, as their test results might vary based on including or excluding certain standard items. A significant amount of time would be needed by teachers to examine, compare and evaluate the data as it appeared in the catalog to ensure that it met the targets they were seeking to meet.

Another key question would be whether or not the data from the MCA accurately reflected what was taught in the unit. Assuming that the MCA data corresponded exactly to the skills taught in the resource, to what extent could the MCA results be expected to reflect the value of the resource? If one teacher uses a resource exclusively to teach a skill, but another uses it as a supplement for students to use on their own, how could the MCA data indicate whether that resource helped learn a particular skill, or did not help them? If used in coordination with other resources, the MCA scores could not be solely attributed to that resource, and might be artificially high or low, depending on how students did overall as a result of their total instruction. The emphasis placed on that item would determine the role it played in the students' scores, and some indication of that emphasis would need to be collected from the teachers using the resource. In reviewing the effect of outcomes from NCLB-related assessments, Frederick Hess concludes:

> The type of metrics developed as part of No Child Left Behind (NCLB) offer little aid here, for the questions needing to be answered involve the quality of particular courses, units, or providers, not the performance of the school as a whole. Trying to judge the performance of a "school" or "teacher" via state assessment results makes little sense in the case of digital learning.[3]

In reviewing the experiment of supplemental education services providers under NCLB, he likewise concludes that "state assessments used for monitoring educational outcomes were not precise enough to detect the impact of thirty or so hours of tutoring, regardless of the provider."[4] The same would be true of detecting the impact of a digital resource on student learning through state assessments--they are simply not precise enough to ascertain meaningful impact.

What would teachers need to know if they were examining a resource that contained information on test score data from students who used that resource? Inevitably there would be questions about the context of the test results:

- Did the students who used the resource have the necessary anticipatory set of skills?

- Were their scores on other skills tested equivalent or were they only high or low in this area?
- Were their demographic profiles similar or vastly different?
- Were there other supports in place for learning these skills or was this the only resource used?

Looking at a sample of test score data to determine if a resource is useful would raise these and other questions. The reliability of the score data would be questionable without further information and research. Unless this information were readily available, teachers would either ignore the score data as an invalid indicator of quality, or eliminate from use resources that might otherwise prove valuable, even though the score data might not be a valid measure of whether the resources would be effective in the context of their classroom instruction. Multiple measures are necessary for true evaluation of student learning and its relationship to learning resources, as recommended by the Smarter Balanced Assessment Consortium: "Assessment, reporting, and accountability systems provide useful information on multiple measures that is educative for all stakeholders."[5]

Outlook

If state test data were intended to be included in the catalog, a significant investment would be required to expand on the data and information collected from users. The additional information necessary to collect would include:

- The MCA strand scores;
- The degree to which the resource was used in the instruction of those strands--a decision would need to be made on whether to include only scores from teachers who used the resource exclusively in the instruction for that set of skills and standards;
- The sample size and other aggregated information on the demographics and context of the data;
- A means of communicating that information into a score or indicator that teachers would find useful.

The cost of gathering these data and incorporating them in a meaningful way would likely be prohibitive. Given that standards and assessments undergo revision every few years, the revision of the catalog information on test results would also require updating. Without a dedicated source of maintenance support, the data would soon become irrelevant, and the initial investment would be lost. There would also be a resource burden placed on the users if they were required to gather and submit all of the test data on the students who used the resource and the context in which it was used. Under the current budget and time constraints faced by districts and teachers, most would opt not to use the resources within the catalog in the face of such a requirement.

Recommendation

The use of proficiency data would not be recommended as a cost effective or academically sound method for including student performance data in the catalog, due to the costs and uncertainties of ensuring that the data accurately and meaningfully reflected the impact of the resource on student proficiency scores.

2. Growth-based assessment (pre and post testing)

In the face of mounting dissatisfaction with point-in-time summative assessments, many states have turned to assessment models that show growth over time.[6] Ideally, some form of initial benchmark is available to show where the student started, and then a post-instruction assessment is given. The level of growth shown by students is more transparently demonstrated, because the beginning and the end are more specifically related to the instruction provided.

In order to provide this type of performance data for resources in the catalog, each item would have to include a pre and post test for students who engaged in the resource. These assessments would be embedded in the resource in such a way that the results would be easily extracted from the users and submitted separately within the catalog system. Over time, the raw data from the pre and post test results would accumulate to show how students who used a particular resource fared from their use of the resource. A ratings system would need to be developed that would allow users to gauge whether student growth was more or less likely for resources used.

There have been some initial steps taken in gathering data from student performance over time to indicate the effectiveness of units or courses.[7] Often they come from within self-contained systems, where the instructional content, assessments, and student data are all connected. As the common core standards and assessment are implemented, a number of organizations connected with the OER Commons (www.oercommons.org) are also designing ways to link the results of the assessments to the content that has been aligned to the common core standards.

Outlook

The promise is great for many of these growth models to provide a richer set of information for stakeholders. A number of challenges exist in bringing this to scale in an open format for large amounts of digital content. First, the level of complexity and variability is fairly wide. There is not full agreement on how growth models are defined and designed. Second, the need for pre and post assessments would place an additional burden on those who wish to share content in the catalog to create these assessments aligned to their content. The number of resources would likely be reduced in the face of this requirement.

Finally, the type of data that was retrieved would still be minimally useful without some knowledge of the students who took the assessments and used the resources, and the context within which they were used. Many of the same uncertainties that exist in the point-in-time assessments would be prevalent in growth-based test data. The cost of including assessments, gathering data on their results, and incorporating that data into a rating process that would be meaningful to teachers would also likely be a significant barrier.

Recommendation

The use of growth data would not be recommended as an effective method for including student performance data in the catalog at this time, due to the costs and burden placed on the developers and the uncertainties of comparing results from different sets of assessments. It is recommended, however, that as the common core standards and assessments are implemented, that catalog reviewers and content producers align where possible to the common core, and use pre and post assessments in the skill levels for which they are most appropriate.

3. Performance-based learning data

One of the more promising movements in digital education is performance or competency-based learning. In a Competency Works Issues Brief from iNACOL, competency-based learning is defined as "a student-centered, customized learning approach that will better engage, motivate, and prepare all students to be career and college ready."[8] The central tenet of competency-based education is that curriculum, instruction and assessment are based on identifying, teaching and evaluating what students can DO, rather than what they KNOW. As explained in the Iowa Task Force Report on Competency-based Learning:

> Knowledge is no longer power; it is ubiquitous. The facts, the figures, the "how-tos" can be found on Google or in YouTube videos created by 12-year-olds! In short, we already live in an anytime, anywhere, any-pace type of world – a competency-based type of world, where if you can figure it out, you can do it.[9]

The following competency-based principles were developed at the Competency-Based Summit co-sponsored by the International Association for K-12 Online Learning (iNACOL) and the Council of Chief State School Officers (CCSSO) in 2010:

- Students advance upon mastery.
- Competencies include explicit, measurable, transferable learning objectives that empower students.
- Assessment is meaningful and a positive learning experience for students.
- Students receive timely, differentiated support based on their individual learning needs.
- Learning outcomes emphasize competencies that include application and creation of knowledge, along with the development of important skills and dispositions.

The Proficiency-Based Learning Task Force of the Smarter Balanced Assessment Consortium (SBAC) developed an expanded definition, emphasizing that instruction is personalized, students direct their learning, and a variety of assessment methods including performance assessments be available. Thus the key element in a competency-based system is that student

performance at the highest levels of thinking skills drives their advancement—students must genuinely demonstrate mastery of learning objectives.

There are numerous implications for adopting this focus, as it would affect concepts of seat time, age-level grouping, credit for learning outside the classroom, reporting of grades and credits, and cross-curriculum project-based applications. For the purpose of this report, the focus will remain on how assessments would need to be designed, implemented, and reported so as to determine whether students achieved what they were expected to based on the use of a particular curriculum resource.

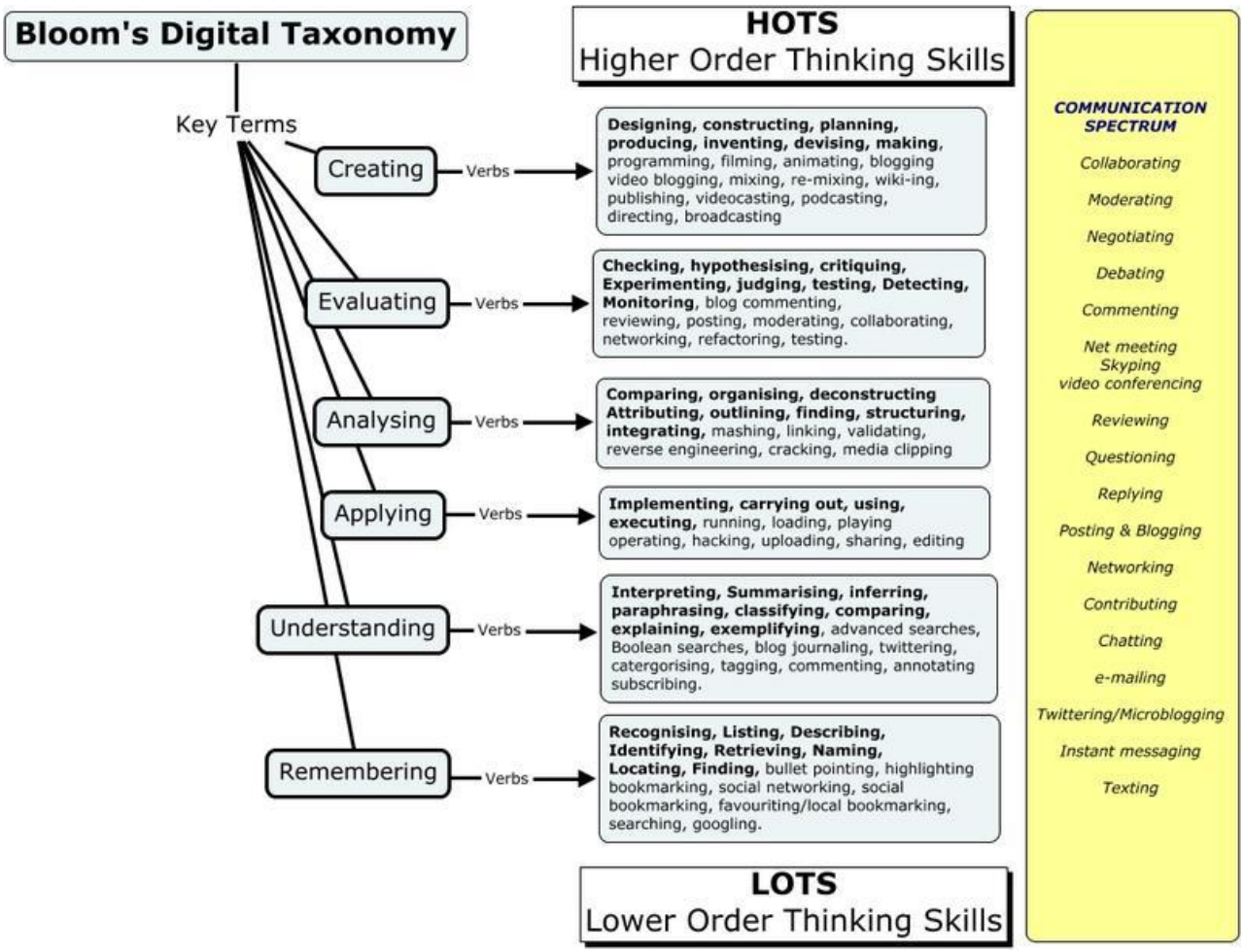
At the core of competency education is student demonstration of learning. Ideally, learning is along a progression of competencies that include:

a. clearly articulated and granular learning targets for what students must be able to "know and do,"
b. clear rubrics for how students will demonstrate mastery at each stage,
c. multiple ways for students to access content and demonstrate mastery, and
d. dashboards with the data showing the level of proficiency or gaps at each stage along the trajectory.

Each student has, in effect, their own personalized learning plan with progress made by demonstrating mastery of competencies. Even in relation to meeting common core standards, the Smarter Balanced Assessment Consortium insists that: "Assessments produce evidence of student performance on challenging tasks that evaluate the Common Core State Standards."[10]

In evaluating resources based on the degree to which student reach competencies, then, it would be imperative to identify the performance goals of the unit. Moreover, it would be equally important to tag these goals based on the type of learning they employ. The type of learning target would indicate the type of assessment that would be necessary to accurately ascertain whether students had met the goals or not. If the learning units are tagged for "level of learning," then the performance metrics would be much more meaningful to teachers or districts looking to adopt a particular resource.

Bloom's Taxonomy of Learning is arguably the most widely accepted system of goal articulation. Developed by Benjamin Bloom in 1956 and revised in 2001, Bloom's Taxonomy and Revised Taxonomy have guided the definitions of higher and lower order thinking skills for over half a century. In response to the emergence of digital creativity tools, Bloom's taxonomy has been further updated by Andrew Churches "to account for the new behaviours and actions emerging as technology advances and becomes more ubiquitous."[11] Critical to the process is the type of assessment that is required to match the type of learning that is expected. As instructional content goes from "narrow" to "deeper" learning, the assessments go from criterion-referenced tests to more holistic performance-based tasks.[12] In the new model, "Create" is the highest level of thinking, and the skills necessary for success in a digital world are carefully incorporated:



http://edorigami.wikispaces.com/file/view/bloom%27s Digital taxonomy v3.01.pdf/65720266/bloom%27s Digital taxonomy v3.01.pdf

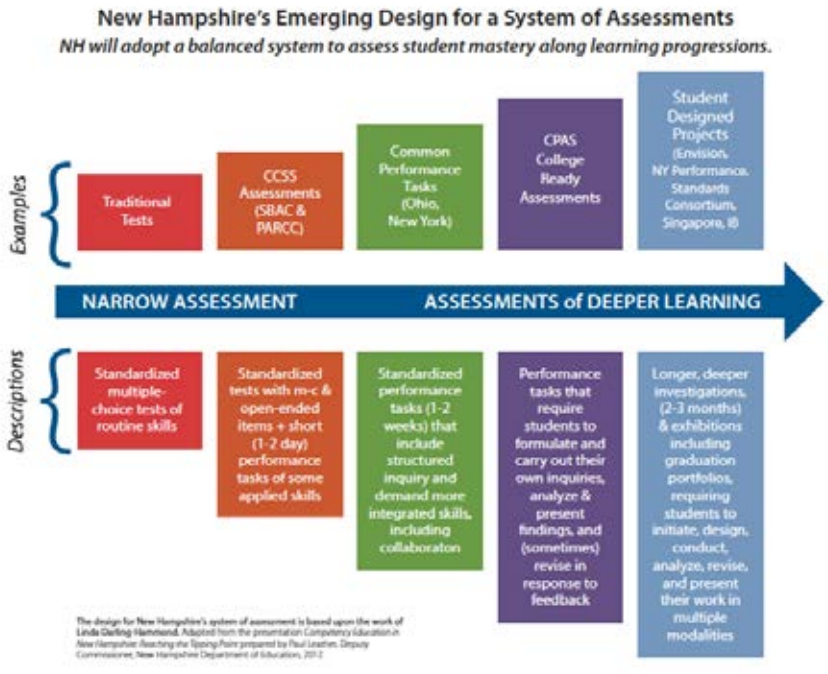
Moving toward curriculum based on these types of goals and assessments that measure them is essential for raising student learning to the highest order of thinking skills necessary. The goals of any learning activity, unit or course would need to be defined in terms of these skills if they are to be measured and deemed valuable for teacher inclusion in the instructional planning process.

The promise of digital curriculum is that it can accelerate and enhance the process toward the highest order thinking skills, or even reverse it to start with higher order skills, like Creating, and work backward.[13] What is being proposed, piloted and implemented in the most innovative initiatives in the country is the alignment of learning objectives to these higher order thinking skills, and the means to assess and evaluate them. Whatever may be the order or the level of thinking skills, these do represent more meaningful outcomes than grades on tests or final grades in classes.[14] The question then is, how could these types of goals, learning targets and assessments provide outcome data that could be used to ascertain the effectiveness of a particular curriculum resource?

Outlook

In order to incorporate this type of performance data into a curriculum catalog, a system of reporting based on competencies and level of proficiency achieved would have to be established. The author of a resource would then indicate which competencies are embedded in their materials and how students demonstrate them in their assessments.[15] Over time as resources were used, the results of the assessments themselves could be reported back into the catalog in a simple "met or not met" format, or in a rubric showing the degree to which a competency had been met. This would provide a more genuine means of connecting the resource to the results, provided the expectations for the resources were made clear to those developing them: the competencies would be clearly outlined, the assessments would be designed to have students demonstrate their learning in a variety of ways, and the results could be reported back according to a standardized entry of whether students met, partially met, or fully met the competencies addressed in the resource. Teachers would then begin to see the level at which a particular unit helped students reach the competencies they were addressing in their curriculum planning.

Where does this lead assessment? New Hampshire has proposed a progression of assessments aligned to these levels of learning. They range from narrower assessments of lower order thinking skills, to more complex evaluations of higher order thinking skills:



Patrick, S. and Sturgis, C. Necessary for Success: Building Mastery of World-Class Skills. A CompetencyWorks Issue Brief, International Association for K-12 Online Learning, 2013, p. 27

The type of assessments described here have not yet been developed for the vast majority of school curricula, due to limited experience and expertise in designing assessments to track learning objectives rather than simply to report on student performance on the whole of a course. Most high school assessments report whether students are proficient in the subject but not how much they learned from the course. Performance assessments are the key, however, to truly attaching outcomes to inputs:

> If targeted assessments are beyond our capabilities to devise, then outcome accountability for digital learning will prove elusive. In short, the value and reach of outcome-based accountability is hostage to the development of high-quality, granular assessments. Until new and satisfactory assessments are devised, outcome accountability will remain a limited tool. And it will remain a nonexistent option for all those courses in which assessments do not exist and are not yet being developed.[16]

A significant investment in training teachers to develop and use performance assessments would be critical to including this type of performance data in the digital curriculum catalog. However, once developed, even with changes in standards, the goals for levels of thinking skills would remain intact.

The lack of integrated data systems is also a significant challenge. Until real-time data from student assessments can be aligned with their prior knowledge, personal interests and specific instructional modules, attaching performance data to instructional materials in a post mortem manner will lack real meaning. A comprehensive system for tracking and reporting student competency achievement has been proposed in an iNACOL issue brief, *Re-Engineering Information Technology Design Considerations for Competency Education*. Long-term plans for implementing competency-based models will include the design of effective IT and SIS systems to articulate the achievement of competencies at a personalized path and pace for each student. Achievement data could then be attached to resources to show how well students have done in reaching the associated competencies when using a particular resource:

> "Systems of assessments" are needed to understand quality assurance based on outcomes. These would provide data upon entry through adaptive assessments showing gaps or mastery of proficiency across the K-12 continuum, ongoing performance-based assessments where students demonstrate mastery exhibited in their work products, formative assessments reflecting student proficiency and skills, and summative "end of unit" or "end of course" validating assessments to provide a much more comprehensive set of data and information to understand student learning outcomes and growth trajectories. Rolling students' individual proficiency and standards-based outcomes data up to the school level could provide a better way to assess how well students are served by a school or program.[17]

The type of data needed will also sustain more personalized approaches to learning, as emphasized in the *Innovate to Educate: System (Re)Design for Personalized Learning, A Report from the 2010 Symposium:*

> Typically, in our one-size-fits-all model, the data referenced is almost solely academic test data. The personalized learning models shared at the Symposium expand this definition to include data on student learning style preferences, correlations between

> instructional approaches and achievement, student interests, and information on the whole child. ... Further instructional technology advances will ensure ever more sophisticated learning platforms and data systems that not only more efficiently identify student needs, but also more effectively identify and deliver matching interventions from a repository of adaptive software, engaging digital content and instructor-delivered resources (online and face-to-face) not otherwise available through traditional means. The maturity of data interoperability and content portability standards will enable educators, students, and software applications to assemble ever more unique, best of breed resources customized to each student.[18]

In Minnesota there has been a significant lack of progress in establishing even the most rudimentary common data platforms among Minnesota schools, making the prospects rather dim for the more elaborate data systems mentioned. Implementing a competency-based system would require a serious commitment from state policy-makers and educational leaders. Early indications from states that have begun to follow this path have been encouraging: New Hampshire in particular has made the most progress in moving from a system based on seat-time and credits to one based on achievement of measurable competencies. Iowa has also focused on competency-based models as the primary driver of innovation and reform.

Recommendations

Short-term: The inclusion of performance data would not currently be feasible in the short-term, because the system for establishing competencies, writing performance-based assessments, and aligning them to standards has not been developed.

Long-term: Development of the systems necessary to include competency-based goals and assessments in all catalog resources is highly recommended. The following are the primary areas that would need to be addressed in order to begin building a world-class system for evaluating resources based on competency.

In addition to the subject area and academic standards content of curriculum, each unit of instruction in the catalog should describe the following:

1. Depth of knowledge and Level of competency/mastery (Blooms revised digital taxonomy)
    - Remember
    - Understand
    - Apply
    - Analyse
    - Evaluate
    - Create (synthesis)

2. Types of Competencies
    - Content competencies

- Cross-cutting competencies (communication, decision making, ability to work with others-collaboration, etc). These are sometimes referred to as 21st century skills.

3. Level of Thinking skills
   - Lower order thinking skill
   - Higher order thinking skill

4. Type of assessment:
   - Content-embedded assessment (e.g., game score)
   - Performance assessment (e.g., project)
   - Adaptive assessment (e.g., online quiz)
   - Summative assessment (e.g., end of unit exams)

5. Student performance data (Future)
   - Centralized data system will interface with the catalog to summarize performance data.
   - Instructional style and delivery format would also be linked to this data.
   - Incoming student characteristics should be linked as well (low, medium, high growth trends). Pre and post assessments would be included at this point.

Conclusions

Competency-based models represent the greatest potential for providing meaningful information for teachers on the value of a particular learning resource. Given the history and solid support in Minnesota for local control, consistent assessment date from point-in-time scores or pre and post tests within individual learning objects will remain fragmented, unwieldy, and costly. Moving toward a comprehensive system of articulating competencies and the performance-based assessments to measure them would provide the greatest return on the investment of time and money that would be necessary to implement ANY of the types of performance data under review. Designing a path in this direction should be a key goal of the next Online and Digital Learning Advisory Council. It is the only way that student performance data could be effectively included in a catalog of resources to show the impact of a particular resource on the degree to which students who used it met their achievement goals.

Notes

1. See for example, Colvin, Richard Lee (2012), *Measures that Matter: Why California Should Scrap the Academic Performance Index*; Hess, F. (2011), *Quality Control of K-12 Digital Learning: Three (Imperfect) Approaches*; and Patrick, S., Edwards D., Watson, J. and Wicks, M. (2012), *Measuring Quality From Inputs to Outcomes: Creating Student Learning Performance Metrics and Quality Assurance for Online Schools*.

2. See Patrick, S., Edwards D., Watson, J. and Wicks, M. (2012), *Measuring Quality From Inputs to Outcomes: Creating Student Learning Performance Metrics and Quality*

Assurance for Online Schools. While the metrics discussed relate to online schools and programs, the arguments can be applied to resources and courses as well.

3. Hess, F. (2011), *Quality Control of K-12 Digital Learning: Three (Imperfect) Approaches*, p. 4.

4. Hess, F. (2011), *Quality Control of K-12 Digital Learning: Three (Imperfect) Approaches*, p. 4.

5. Smarter Balanced Assessment Consortium Theory of Action (2010), p. 2.

6. For discussions on the movement toward growth models, see Patrick, S., Edwards D., Watson, J. and Wicks, M. (2012), *Measuring Quality From Inputs to Outcomes: Creating Student Learning Performance Metrics and Quality Assurance for Online Schools;* and Hill, P., *Steps in the Right Direction: Assessing "Ohio Achievement Everywhere' the Kasich Plan,* (2013) Thomas B Fordham Institute.

7. For review of common core growth models, see the ETS Consortium Common Assessments: http://www.ets.org/k12/commonassessments.

8. Patrick, S. and Sturgis, C. (2013), *Necessary for Success: Building Mastery of World-Class Skills,* p. 5.

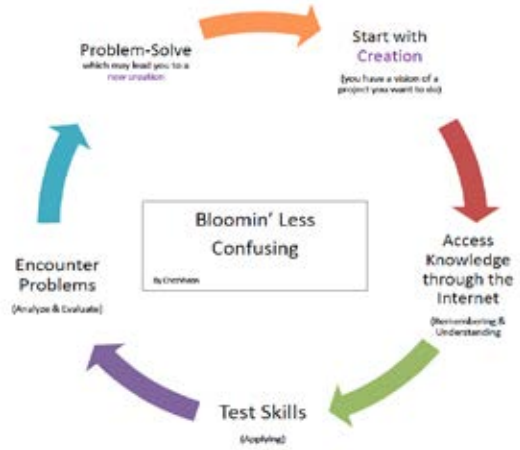
9. Competency-Based Education Task Force Preliminary Report (2013), Iowa Department of Education, p. 8.

10. Smarter Balanced Assessment Consortium, Theory of Action (2010), p. 10.

11. Churches, A. (2009), *Bloom's Digital Taxonomy*, p. 3.

12. For a thorough discussion of the emergence of the revised taxonomy and the new digital taxonomy, see the Introduction to Churches, A. (2009), *Bloom's Digital Taxonomy.*

13. Vivian Chow describes this revised taxonomy and explains how the order can be reversed in a digital learning environment:



http://www.coetail.com/chezvivian/files/2013/02/Vivians-New-Bloom-April.png

14. For a variety of descriptions of competencies, see the IB learner profile booklet (2008) and the characteristics of student development in the learner profile, New Hampshire Course Level Competencies (2010), p. 5.

15. For further information on the Depth of Knowledge, see Norman Webb Wisconsin Center for Education Research (http://wat.wceruw.org/index.aspx) and Missouri Department of Education School Improvement Program's Depth of Knowledge chart at http://dese.mo.gov/divimprove/sia/msip/DOK_Chart.pdf.

16. Hess, F. (2011), Quality Control of K-12 Digital Learning: Three (Imperfect) Approaches, p. 5.

17. Glowa, L. (2013), *Re-Engineering Information Technology Design Considerations for Competency Education*, A CompetencyWorks Issue Brief, International Association for K–12 Online Learning, p. 5.

18. Innovate to Educate: System (Re)Design for Personalized Learning, A Report from the 2010 Symposium, p. 30.

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Key websites with further information:

College and Career Readiness (CCR):
https://collegeready.epiconline.org/portal/public/

Competency-Based Pathways:
https://sites.google.com/site/competencybasedpathways/home

Dynamic Learning Map (network of sequenced learning targets):
http://dynamiclearningmaps.org/

Envision Education:
http://www.envisionschools.org

ETS Consortium Common Assessments:
http://www.ets.org/k12/commonassessments

Iowa Department of Education, Competency Based Education Task Force:
http://www.educateiowa.gov/index.php?option=com_content&id=2650&Itemid=5159

Missouri Department of Education, Depth of Knowledge (DOK) Levels:
http://dese.mo.gov/divimprove/sia/msip/DOK_Chart.pdf

New York Performance Standards Consortium:
http://performanceassessment.org/

Partnership for Assessment of Readiness for College and Careers (PARCC):
http://www.parcconline.org

Singapore Examinations and Assessment Board:
http://www.seab.gov.sg

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