Building a Conceptual Framework for Assessment Literacy

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Abstract

There is widespread agreement regarding the need for increased assessment literacy among educators, policymakers, and other consumers of information from educational assessments. There is less agreement, however, regarding the meaning of assessment literacy; that is, the knowledge and skills needed by people to interpret and use assessment effectively. In this article, we propose a framework in which assessment literacy is context dependent and multi-dimensional. Assessment literacy is context dependent in the sense that a person's ability to use assessment effectively cannot be separated from other knowledge and skills necessary for them to perform effectively in their role. A teacher's level of assessment literacy cannot be considered separately from that teacher's content knowledge and pedagogical skills. Assessment literacy is multiple dimensional in the sense that the interpretation and use of assessment requires knowledge and skills (i.e., literacies) related to the principles of testing, measurement, and the use of data. The relative importance of those three areas and the specific knowledge and skills required to use assessment effectively will differ among teachers, administrators, and policymakers. An understanding of assessment literacy as context dependent and multidimensional has implications for the design of instructional materials and professional development activities intended to enhance it.

Building a Conceptual Framework for Assessment Literacy

The concept of improving assessment literacy encompasses the content knowledge and skills that define it, multiple stakeholders who require it, and a variety of approaches used to convey it. Recently, the issue most often addressed under the banner of assessment literacy is the call for teacher education and professional development programs to better prepare teachers to deal with an onslaught of data from large-scale state assessments, interim assessments, local district- or school-wide assessments, and classroom-based assessments. Traditionally, the term assessment literacy evokes measurement principles such as validity and reliability accompanied by complex equations, statistical terms, and images of normal curves, ogives, and error bands. Notably, however, there is one aspect of assessment literacy on which there is little dispute: the lack of it among educators.

According to National Council on Teacher Quality (2013), teacher preparation programs "are not delivering new teachers with needed skills, forcing districts to dedicate professional development dollars to accomplish what they believe higher education should have done in the first place" (Greenberg, McKee & Walsh, 2013). In the Council's review of 690 teacher education programs, only 24% adequately train teachers how to assess learning and use student performance data to inform instruction. What does this mean? Pre-service teachers do not have adequate opportunities to wrestle with assessment-derived data nor to thoroughly understand its use in informing instruction. The NCTQ results follow a 2010 report by the National Council for Accreditation of Teacher Education(NCATE), the largest accreditor of teacher preparation programs, which recommended that "candidates be presented with multiple and rich course material in their preparation that will enable them to become assessment-literate and data-wise"

(Elliott, 2010). The NCTQ and NCATE reports reflect the need to correct the ongoing state of affairs which was described by Popham (2009) in this way, "The gaping gap in teachers' assessment-related knowledge is all too understandable.… Regrettably, when most of today's teachers completed their teacher-education programs, there was no requirement that they learn anything about educational assessment."

The call for improved assessment literacy is not isolated to teachers. Administrators and policymakers need to be assessment literate due to handle the pressure of data-driven decision-making practices (Park, 2009). Since the No Child Left Behind Act of 2001 (NCLB), educational leaders have been required to base their decisions on evidence. They are "now required to analyze, interpret and use data to make informed decisions in all areas of education" (Park, 2009). However, research shows that educational leaders who are inundated with so much data often resort to ideology and prior knowledge to make decisions (Coburn, 2009; Gerzon, 2015). The NCATE report, however, did not provide specific suggestions on how to integrate this new information into existing coursework or provide it through new coursework. Gerson (2015) urged administrators to lead the charge in supporting efforts to develop teachers' data competency. However, it has become clear that leaders and administrators are struggling to stay ahead of the data onslaught. Unfortunately, there is scant evidence of successful professional development in dealing with data (Horn & Little, 2010; Lachat & Smith, 2005; Love, 2004; Supovitz & Klein, 2003).

Our proposed framework for assessment literacy is grounded on the premise that assessment is a process that involves the collection and evaluation of evidence to answer a specific question. If the purpose of assessment is to answer a clearly defined question, a critical

point in the assessment process is determining whether there is sufficient evidence available to answer that question. If there is sufficient evidence, the question can be answered. If not, additional evidence must be collected and evaluated. In its most basic, simplified form, the assessment process follows the flow chart shown in Figure 1.

[Insert Figure 1 Here]

Working from that description, it follows that assessment literacy must encompass the knowledge and skills necessary to effectively and efficiently determine when sufficient evidence has been gathered. In fact, the ability to evaluate the sufficiency of evidence can be viewed as the cornerstone of assessment literacy.

The term sufficiency of evidence refers to determining whether there is enough evidence to prove a claim, make a decision, or answer a question. Sufficiency refers to the adequacy of the evidence, not necessarily its quantity. The term sufficient also implies that the evidence need not be conclusive, but must provide an acceptable degree of certainty. All of which leads to the question, 'How much evidence is enough?' Unfortunately, there are no simple or universal answers to that question. The answers are context dependent. In the context of K-12 education, the knowledge and skills needed to answer that question define assessment literacy.

This paper is divided into three main sections. In the first section, we review the literature to provide an overview of existing definitions and frameworks of assessment literacy. In the second section, we define the individual domains of knowledge and skills that our proposed framework will comprise and discuss the importance of context with respect to a selected set of key stakeholders. In the third section of the paper, we final section, we describe and discuss our proposed assessment literacy framework.

Overview of Existing Definitions and Frameworks

Existing Definitions of Assessment Literacy

A prerequisite to improving assessment literacy is arriving at an agreed upon definition of the term. When defining assessment literacy, there is a natural tendency to list the specific assessment-related knowledge, understanding, and skills an assessment-literate educator must possess (Donoho, 2000; Stiggins 2002; Popham, 2004; Boyles 2006; Gareis and Grant 2015; Xu and Brown 2016[1]). Often, these definitions consist of a straightforward list of topics and concepts such as the following drawn from the Michigan Assessment Consortium (MAC) Assessment Literacy Standards for Teachers (Michigan Assessment Consortium, 2015):

- Knowledge: Teachers should know:
  - i There are different purposes for student assessment
  - ii The definitions of and uses for different types of assessments
  - iii Non-technical understanding of statistical concepts associated with assessment (e.g., measures of central tendency and variability, reliability, and validity)
- Performance: Teachers should be able to:
  - iv Select and use various assessment methods appropriate to assessment purposes and learning targets.
  - v Implement the 5-step process for assessment development
  - vi Use of a variety of protocols for looking at and scoring student work
  - vii Use of assessment results to make appropriate instructional decisions for individual students and groups of students
  - viii Use assessment results appropriately to modify instruction to improve student achievement

Conversely, the list could be expanded into a list of potential assessment literacy concepts for educators as Popham (2012) produced, including for example,

- The fundamental function of educational assessment – namely the collection of evidence from which inferences can be made about students' covert skills, knowledge, and affect.
- Reliability of educational assessments, especially the three ways in which consistency evidence is reported for groups of test-takers (stability, alternate-form reliability, and

[1] A comprehensive breakdown of assessment literacy interpretations from existing research can be found in Xu and Brown (2016)

internal consistency), and how to gauge the consistency of assessment for individual test takers.
- The prominent role three types of validity evidence (content-related, criterion-related, and construct-related evidence) should play in building arguments to support the accuracy of test-based interpretations.
- Scoring of students' responses to constructed-response test items, especially the distinctive contribution made by well-formed rubrics.
- Designing and implementing formative assessment procedures consonant with both research evidence and experience-based insights about the likely success of such procedures.
- How to determine the appropriateness of an accountability test for use in evaluating the quality of instruction.

Moving beyond the list of skills or topics, Popham (2011) offers an elegant definition of assessment literacy: "Assessment literacy consists of an individual's understandings of the fundamental assessment concepts and procedures deemed likely to influence educational decisions". What makes Popham's definition elegant is that it does not divorce understanding of assessment concepts and procedures from the context in which they will be used—that is, to influence educational decisions. Many people reading that definition will focus on the words "understandings of the fundamental assessment concepts and procedures" as the critical aspects to identify an assessment literate person. However, the second half of the definition, "deemed likely to influence educational decisions," is equally important. Assessment literacy includes not only an understanding of assessment concepts and procedures, but also the proficiency to apply them to influence educational decisions as a teacher, administrator, or policymaker (or student, parent, taxpayer …).

Existing Frameworks

Generally, assessment literacy frameworks have been geared towards classroom assessment practices largely utilized by teachers. In particular, these frameworks address gaps in the assessment literacy of preservice and in-service teachers. One framework focusing on pre-

service teacher assessment literacy was proposed by Siegel and Wissehr (2011), who focused on classroom principles of assessment for learning and teacher knowledge of assessment tools and purposes. Similarly, Gareis and Grant (2015) constructed a teacher-focused framework categorizing assessment literacy into three aptitudes for teachers and administrators. Their three suggested domains are: types of measures, quality of measures, and results and their uses (Gareis & Grant, 2015). Recently, Kahl, Hofman, and Bryant (2012) suggested an "assessment literacy domain framework," which builds on existing standards written by various educational institutions. They recommend assessment literacy mechanisms that emphasize "a process-oriented standard that embodies necessary unpacking and the use of the results to inform program and performance measure design".

A majority of assessment literacy frameworks focus at least as much on professional development paradigms as they do on describing assessment literacy proficiencies. Inbar-Lourie's (2008) social-constructivist perspective framed the need for assessment literacy via language educator professional development. However, without a clear definition of the components of assessment literacy, the scope of his framework is limited.

In the same vein, teacher-focused professional development frameworks such as Xu and Brown (2016) proposed the need to "create an overall trajectory of professional development in assessment literacy that encompasses all phases of teacher education and development." They support their professional development framework chiefly by proposing a framework of teacher assessment literacy in practice (TALip). The core concept of TALiP encompasses three components of assessment literacy, including a knowledge base, which Xu and Brown describe as a "necessary, but not sufficient condition" for assessment literacy; an understanding of the

interconnectedness of assessment, teaching, and learning which results in decision-making based on the intersection of personal perspective and theory; and teacher learning which ultimately leads to the reconstruction of teachers' identity as an assessor.

In the current data-driven testing climate, data literacy and its existing frameworks are extremely relevant to assessment literacy. Jimmerson and Wayman (2015) outline a framework for data-related professional learning in which they expand on Supovitz's (2010) framework, "Supovitz (2010) situates data use in a cycle of continuous improvement and posits that school organizations move through four ordered processes" (p. 5). These ordered processes are: data capture, meaning-making, information sharing, and knowledge codification. Jimmerson and Wayman (2015) expand on this framework by adding that individual learning and organizational processes are reciprocal. They "posit that effective data-related professional learning includes what educators learn independently and what they learn in collectives" (p. 4).

Furthermore, data use is of paramount concern to assessment literacy. Coburn and Turner (2011) proposed a framework for data use. At the center of their framework are *processes of data use* which are nested within an *organizational and political context*. Within this context, data use may be impacted by *interventions to promote data use* such as tools, comprehensive data initiative, and accountability policy. The final component of the framework is the *potential outcomes* that may result from improved data use including organizational change, change in practice, and student learning.

Data literacy, much like assessment literacy, has been mainly teacher focused. Gummer and Mandinach (2015) put forth a framework for data literacy for teachers that includes "three important domains: disciplinary content knowledge and practices, pedagogical content

knowledge and practices, and data use for teaching knowledge and skills… [and] includes the components of the inquiry process" (p. 14). Lastly, Athanases, Bennett, and Wahleithner (2013) propose a framework of systematicity in teacher inquiry that informs data literacy. The model includes five levels. From the bottom up, these are a data collection event, analysis, information for use in teaching, synthesis and lastly, teacher knowledge, which "can develop from reflecting on rounds of collection and analysis" (p. 11). The authors state that data literacy for teaching is made up of these framework elements: data collection events, analysis, and using the information for teaching.

Gap in the current frameworks

The existing frameworks, coupled with empirical research mainly highlight the need for improved paradigms for both assessment literacy and also for professional development to enhance it. None of the existing assessment literacy frameworks or definitions satisfactorily identify the multiple competencies that assessment literacy comprises or differentiates among them. Furthermore, current frameworks do not consider the full array of stakeholders, such as administrators, policymakers, and parents, who also require assessment literacy to inform their own decisions and interpret the decisions made by others. A more expansive and inclusive conception of assessment literacy is needed that accounts for the role of context in determining the knowledge and skills needed by various stakeholders to effectively use assessment to inform critical decisions—that is, to evaluate the sufficiency of available evidence and determine whether additional evidence is necessary.

Building a New Assessment Literacy Framework

Assessment Literacy Domains

Reading through any discussion of assessment literacy, it is obvious that it includes skills from multiple, distinct areas. More often than not, knowledge and skills from distinct disciplines are conflated under the general heading of assessment literacy. Consistent with our emphasis on the ways assessment literacy differs in different contexts, we feel that it is also critical to explicitly acknowledge the distinct skills sets that assessment literacy comprises. While there may be other classification schemes that work well[2], we propose the following three distinct sets of skills as fundamental components of assessment literacy:

- Testing Literacy – the understanding of the fundamental principles of test design, development, and use.
- Measurement Literacy – the understanding of fundamental measurement principles, particularly those related to validity and the uncertainty of measurement
- Data Literacy – the possession of the basic skills needed to organize and manipulate data so that it can be analyzed, interpreted, and used appropriately

There is obviously overlap across the three categories. The categorization does not imply that the principles in each of the categories should be addressed separately or out of context. However, educators' understanding of assessment concepts and the development of instructional materials can be improved by a better understanding that assessment literacy is multidimensional, requiring knowledge and skills from a variety of disciplines.

Testing Literacy

We use the term testing literacy to refer to the knowledge and skills directly related to test design, development, and use. We acknowledge that this naming convention is not ideal given

[2] The MAC Assessment Literacy Standards, for example, subdivide their Knowledge category to include knowledge of assessment concepts, measurement concepts, and how to effectively interpret, use, and communicate results from assessments.

the tendency in the field to use the terms assessment and testing interchangeably. The synonymous use of the terms test and assessment to describe an instrument (formal or informal) and also to describe the general process of evaluating student performance has been a longstanding source of confusion (Black, 1998; Shepard, 1994). In spite of the potential for confusion, however, we feel that it is critical to distinguish this set of knowledge and skills from the other domains within our expanded view of assessment literacy. Therefore, within our proposed framework, we define testing literacy as the understanding of fundamental principles of test design, development, and use; and view it as simply one domain of knowledge and skills within the broader conception of assessment literacy.

In calling this domain testing literacy, we acknowledge that also we run the risk of readers inferring that the terms test design, test development, and test use refer only to formal, written instruments containing items with a single correct answer or problems with one known solution. Rather, we are using the term *test* in the broadest possible sense to refer to any formal or informal instrument or procedure used to gather evidence about student performance. This may include oral questions posed by teachers in a classroom, teacher observations of student performance, a teacher-constructed quiz or test, or a large-scale standardized state assessment.

Measurement Literacy

Measurement concepts are routinely and clearly identified as a critical component of assessment literacy and are well-represented in the lists of required elements in existing assessment literacy frameworks. It is often the case, however, that measurement concepts are either conflated with testing concepts or are treated considered in isolation and out of context. Finding the right balance in identifying the level of applied measurement understanding that is critical to various users of assessments and assessment information has been difficult.

Daniel and King's (1998) study of the testing and measurement literacy of elementary and secondary teachers is an illustrative example of both the central role of measurement principles in assessment literacy and of empirical work that explicitly conflates the separate areas of testing and measurement into "testing and measurement" concepts and procedures. They used a Likert scale task to ask teachers about their familiarity with basic measurement principles, using key terms such as reliability, tendency, content validity, predictive validity, correlation, range, criterion related, mean, median, mode, and standard error. Furthermore, the questionnaire required teachers to make applied judgements about these concepts (i.e. interpreting correlations coefficients). This is not an isolated example, as basic measurement principles have been lumped in with assessment literacy competencies in a variety of articles (Lambert 1991; Brookhart 2001; Boyles 2006; Davies 2008; Popham 2009; Taylor 2009; Gareis and Grant 2015).

Technical knowledge of basic measurement principles has also been measured by assessment literacy tests or inventories such as the Assessment Literacy Inventory, or ALI, (Mertler and Campbell 2005) and the Assessment Knowledge Test, or AKT (Wang, Wang, and Huang 2008). These two recent teacher-focused assessment literacy measures explicitly address a teacher's knowledge of measurement principles such as those listed in the previous paragraph. These measures emphasize the importance of measurement literacy as a contributing facet to a teacher's overall assessment literacy.

However, while knowledge of these concepts is beneficial, the current framework suggests that teachers may mostly benefit from a working, and non-theoretical, understanding of measurement principles. Brookhart (2001) turned to this issue when she noted that her research questions attempted to measure teacher assessment literacy, but were in fact based on the

knowledge of measurement principles. Brookhart (2011) developed a set of assessment literacy principles that further capitalized on this notion. Recent assessment literacy standards such as those developed by the Michigan Assessment Consortium also attempt to frame measurement principles within assessment literacy in a way that meets the need for practical measurement knowledge that is useful for teachers (MAC, 2015). Lastly, only Taylor (2009) suggested that the knowledge of these measurement principles is also necessary for administrators.

Thus, the proposed framework defines measurement literacy as the understanding of the fundamental measurement principles necessary to complete the assessment process, suggesting that a practical, but not necessarily theoretical, understanding of measurement concepts like error is necessary for teachers. Moreover, this crucial distinction emphasizes measurement literacy as one of three key skills necessary for being assessment literate. Several skills and key ideas from this framework are found throughout assessment literacy literature, but not identified as measurement literacy or further developed. Specifically addressing and filling this gap in knowledge and training across teachers and administrators is increasingly paramount as the amount of testing and data continues to increase.

Data Literacy

Data literacy has also been conflated with assessment literacy. However, data literacy is a broad concept that covers more than just data derived from assessments (Mandinach & Gummer, 2012; Mandinach & Gummer, 2013; Mandinach, Gummer, & Friedman, 2015). Data literacy also has no common definition (Gummer & Mandinach 2015; Koltay, 2015; Mandinach & Gummer, 2012; Mandinach & Gummer, 2013; Mandinach, Gummer, & Friedman, 2015). Despite the lack of a common definition of data literacy, many of the existing definitions include

some common attributes. Most definitions state that to be data literate, an educator needs to be competent in data collection, analysis, interpretation, and the ability to execute actions based on interpretation (Athanases, Bennett, & Wahleithner, 2013; Bocala & Boudett, 2015; Gummer & Mandinach 2015; Mandinach & Gummer, 2013; Mandinach, Gummer, & Friedman, 2015).

For example, Mandinach and Gummer (2013) define data literacy as "knowing how to identify, collect, organize, analyze, summarize and prioritize data… how to develop hypotheses, identify problems, interpret the data, and determine, plan, implement, and monitor courses of action" (p. 30). Similarly, Athanases, Bennett, and Wahleithner (2013) define data literacy as the "capacity to conduct focused and purposeful collection and analysis of student work, reflections, and process data, in order to promote reflection on student learning and to guide and inform new understandings of practice" (p. 9). Many of the data literacy definitions pertaining to educators focus on the knowledge and skills needed by teachers rather than administrators. Mandinach, and Gummer (2013), however, state that administrative data literacy requires similar skills as teacher data literacy; but also includes planning for data use, establishing a vision for data use, and aligning learning goals with available data. These skills are distinct from teacher data literacy in that they require integrating "educational leadership and management skills" (p. 32).

The definitions of data literacy presented above are quite expansive, encompassing not only skills for collecting and analyzing data commonly associated with assessment literacy, but also knowledge and skills necessary to know what data to collect and how to effectively proceed from data analysis to application. Under such definitions, one could conclude that data literacy is all that is necessary to be an effective educator. In our framework, we adopt a narrower definition of data literacy within the concept of Assessment Literacy.

As educators' use of both formal and informal assessment data becomes more commonplace, educators must be comfortable using tools to perform routine tasks such as sorting and filtering data, generating reports, and combining data across a variety of sources. For the purposes of the proposed framework, we define data literacy as possessing the basic skills needed to organize and manipulate data so that it can be analyzed, interpreted, and used appropriately. Data literacy becomes a part of assessment literacy at the point where educators need to organize and manipulate data so that it can be analyzed and interpreted appropriately.

Stakeholders and the Importance of Context

If assessment literacy is context dependent, then it follows that one must understand the context in which an educator is functioning to define the knowledge and skills necessary for that educator to be assessment literate. In this section, we address context for three broad categories of educators: teachers, administrators, and policymakers (Figure 2). The idea of stakeholder-specific assessment literacy knowledge has been suggested, but not developed or considered in the context of the multiple components of assessment literacy. Chiefly, the impact of the inter-relationships between levels of stakeholders (i.e., administrators and teachers, policymakers and administers, policymakers and teachers) on the knowledge and skills needed by each group of stakeholders have not previously been developed.

Of course, there will be variation in context within as well as across the three broad categories of teachers, administrators, and policymakers. There are certainly differences among the teaching contexts and assessment literacy needs of an elementary school teacher, a middle school science specialist, and a high school special educator. There will also variation within the broad class of administrators that includes, for example, building level principals, district

curriculum directors, and superintendents. However, there are enough similarities in roles and responsibilities within each of these categories— and significant enough differences across categories—to illustrate the importance of context in determining how best to improve assessment literacy.

Of course, there are additional stakeholders who could also be considered such as students, parents, and the general public. Their context for the interpretation and use of assessment is different from that of teachers, administrators, and policymakers. However, those groups are beyond the scope of our discussion.

Teachers

For teachers, assessment involves gathering and interpreting evidence to improve instruction and learning for individual students. As suggested in the MAC standards, quality assessments are a critical attribute of effective teaching. It can be argued that at the classroom level, assessment and instruction must be tightly interwoven to have a positive impact on student learning. Therefore, we identify instruction as teachers' primary context for assessment literacy.

If we accept that the definition of an assessment literate teacher includes the capacity to use the information gathered from student assessment, deficiencies in pedagogical knowledge and skills must limit the extent to which that teacher can be considered assessment literate. That is, teachers' assessment literacy will always be limited by their instructional skills.

Additionally, it should go without saying that teachers' instructional literacy is similarly bounded by their content literacy. That is, there are limits to how effective a teacher's instruction within a content area can be without a deep understanding of the content they are teaching.

For teachers, we must consider assessment literacy always within the context of a teacher's content knowledge and their pedagogical knowledge and skills. Based on a traditional

broad definition of curriculum, taken together, a teacher's content knowledge, pedagogical knowledge and skills, and assessment literacy constitute the teacher's curriculum literacy.

Administrators

In contrast to teachers, the primary context for administrator assessment literacy is often evaluation – program evaluation and personnel evaluation. One or more steps removed from instruction, administrators often rely upon assessment to make judgments regarding the effectiveness of an instructional or curricular program or to compare the effectiveness of two or more programs, approaches, or even staff members. To a certain degree, however, administrators may also need to function within the context of teachers; That may be the case in their role as teaching supervisors, which requires them to observe, evaluate, and provide feedback to improve instruction. Certain administrators may also select assessment-related resources and materials for teachers.

Policymakers

Educators in our category of policymakers are even further removed from the classroom than administrators. They may be large-district superintendents, state department of education staff, or United States Department of Education staff. Policymakers may also include non-educators such as elected officials at the local, state, and federal level. Distinct from the program and personnel evaluation context of administrators, policymakers are primarily involved in data-driven assessment for the purposes of program monitoring. There may be an evaluation aspect to program monitoring, but that evaluation would generally be more removed from the actual program than the type of evaluation conducted by administrators (e.g., more focused on outcomes and summative judgments). The four pillars defining the mission of the United States Department of Education provide an example of the context of policymakers:

- Establishing policies on federal financial aid for education, and distributing as well as monitoring those funds
- Collecting data on America's schools and disseminating research.
- Focusing national attention on key educational issues
- Prohibiting discrimination and ensuring equal access to education.

Context Summary

We have identified three educator-context sets: teacher-instruction, administrator-evaluation, policymaker-data collection. Those sets are clearly not disjointed. As suggested throughout, there will be a degree of overlap. It would be inappropriate, however, to regard the educator categories and contexts as completely overlapping. The assessment literacy skills of an effective teacher will most certainly differ from those of an effective administrator and from those of an effective policy maker.

Proposed Assessment Literacy Framework

We began with the premise that assessment is a process that involves the collection and evaluation of evidence to answer a specific question. If the purpose of assessment is to answer a clearly defined question, a critical point in the assessment process is determining whether there is sufficient evidence available to answer that question. If there is sufficient evidence, the question can be answered. If not, additional evidence must be collected and evaluated. Our proposed framework for assessment literacy flows from critical question at the center of the assessment process: *Is the available evidence sufficient to answer the question?*

Consideration of whether the available evidence is sufficient leads logically to the follow-up question: *What evidence is needed to answer the question?*

What evidence is needed to answer the question?

The ability to answer this question requires a deep understanding of the topic of the question and the context in which it is being asked. The first principle of our assessment literacy framework, therefore, is: **Assessment literacy cannot be considered in isolation from the other critical knowledge and skills needed for a person to function in their role.**

Assessment is a tool that can only be used effectively by those who possess the prerequisite knowledge and skills required for their position. For teachers, this means that assessment literacy cannot be considered in isolation from content knowledge and pedagogical knowledge and skills. Considered as a whole, the content knowledge, pedagogical knowledge and skills, and assessment-related knowledge and skills necessary to function as a teacher constitute what can be referred to as the teacher's *curriculum literacy* – using the broad concept of curriculum as planned opportunities for learning.

In Figure 2, we depict the nesting of assessment literacy for teachers within content and pedagogy. In short, we suggest that a teacher lacking appropriate content knowledge and pedagogical skills cannot be an assessment literate teacher. Corresponding schema would apply to other stakeholders. For administrators, competency in program evaluation and/or the principles of industrial and organizational psychology might be the prerequisite knowledge base. For policymakers, a variety of knowledge bases and skill sets, including an understanding of public policy may be necessary to use information from assessment effectively. In each context, however, possession of a solid base of knowledge related to the stakeholder's primary function is a prerequisite for assessment literacy.

[Insert Figure 2 Here]

How should the evidence be obtained, processed, and evaluated?

After determining what evidence is needed, educators must then focus on questions such as

- *How can I obtain the evidence that I need?*
- *How do I process the evidence when it has been collected?*
- *How do I analyze and evaluate the evidence to make appropriate inferences?*

For teachers, the process of obtaining evidence might require knowledge and skills related to test construction (e.g., what types of items will elicit the desired information) and formative assessment practices (e.g., at what point in the instructional process should particular questions be asked and how should they be asked). For school administrators, the relevant knowledge may be related more to test selection and the interpretation of test results. Policymakers presented with results from large-scale assessments may have to understand what the assessment was designed to measure and under what conditions the data were collected.

The questions related to processing evidence after it has been collected addresses the knowledge and skills needed to proceed from raw data collected during the assessment process to information that can be used to inform a judgment. For teachers, this may involve the knowledge and tools needed to combine scores from individual test items into a total test score, or to combine scores across tests and projects into a quarterly or year-end grade. For administrators, processing and evaluating evidence may require organizing and manipulating data from multiple teachers and schools into a useful format. Policymakers, often provided with summary information must have the knowledge and skills to ask appropriate questions about the source data and how it was processed and analyzed. .

Additionally, understanding the overarching measurement principles related to uncertainty and probability, fairness, and comparability is critical to collecting, processing, evaluating, and ultimately determining the sufficiency of evidence.

In summary, the knowledge and skills required to answer the questions posed above require a combination of testing literacy, measurement literacy, and data literacy. However, the specific skills within each of those domains and the balance of skills needed across the domains will vary significantly across stakeholders. The second and third principles of our proposed assessment literacy framework explicitly acknowledge that reality: a**ssessment literacy comprises a blend of testing, measurement, and data literacies; and the particular testing, measurement, and data skills needed to be assessment literate are vary based on an educators' roles and responsibilities**

As depicted in Figure 3, assessment literacy comprises a blend of testing, measurement, and data literacy for all stakeholders; however, the balance across those literacies varies significantly depending on context. The framework also acknowledges an overlap or interconnection among responsibilities, suggesting that certain stakeholders may have to possess a degree of the assessment literacy skills of stakeholders who report to them (e.g., building administrators and teachers) or of stakeholders most directly impacted by their decisions.

[Insert Figure 3 here]

As a starting point, we propose testing literacy as the core set of knowledge and skills required by teachers; measurement literacy as the core knowledge and skills required by administrators; and data literacy as the heart of assessment literacy for policymakers.

Additionally, we propose a model for how the balance across domains varies by stakeholder. The specific levels of testing, measurement, and data literacy each stakeholder requires and the intersections of those literacies across stakeholders is a topic for further research and discussion.

Discussion

Since the turn of the 21st century, data-driven decision making has become "a mantra of educators from the central office to the school, to the classroom" and assessments have been a major source of that data and a focus of state and federal accountability policies (Marsh, Pane, and Hamilton, 2006). Fueled by the Race to the Top Assessment Program, states and the federal government devoted unprecedented resources over the last six years to designing and developing high-quality assessments (USED, 2010). Technology-driven personalized learning systems promise to provide educators with unprecedented access to real-time data about student performance in the classroom (Herald, 2016). A major goal of each of these efforts has been to enhance equity by ensuring that assessments are accessible to all students, to precisely measure performance along the full proficiency continuum, and to provide timely, actionable data and information for all intended users. Toward that end, much attention has been devoted to the assessment results reported and the use and interpretation of those results for instruction and accountability. Assuring access to high-quality assessment systems, however, is a necessary, but not sufficient, step in building equity and closing gaps in academic achievement. Equally important is ensuring that the people charged with implementing those systems and interpreting their results have the capacity to use them effectively. That requires ensuring there are sustainable, high-quality efforts to build the capacity of teachers, administrators, and policymakers in the valid use of data and information produced through large-scale assessments

as well as through high quality assessment practices at the local level. Assessment literacy is a linchpin in the effort to produce and use high-quality assessments, to close achievement gaps and to improve instruction and learning for all students.

In developing the Assessment Literacy Framework described in this paper, our focus was the efforts needed to develop, support, and sustain assessment literacy. We began with Popham's practitioner-focused definition of assessment literacy: Assessment literacy consists of an individual's understandings of the fundamental assessment concepts and procedures deemed likely to influence educational decisions (Popham, 2011). Working from that definition, it became clear that differences in educational decisions made by teachers, administrators, and policymakers mean that the fundamental assessment concepts each must understand and apply to make those decisions must also differ. Consequently, the assessment literacy infrastructure must be sufficiently expansive and flexible to ensure that everyone has the appropriate understandings to support their educational decisions. Our review of the literature on assessment literacy and existing frameworks revealed that current concepts of assessment literacy found that there are significant gaps in current conceptions of assessment literacy. The descriptions of assessment literacy are often incomplete, focus on teachers, and address isolated skills out of context.

Through this framework, we hope to close the existing gaps and provide a comprehensive picture of assessment literacy—a view of assessment literacy that is multidimensional, grounded in practice, and nested within the role-specific knowledge and skills of teachers, administrators, and policymakers. The framework should serve as a useful tool for states, local education agencies, educator preparation programs, and others developing programs and materials to increase assessment literacy and improve the instruction and learning of all students.

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Figure 1

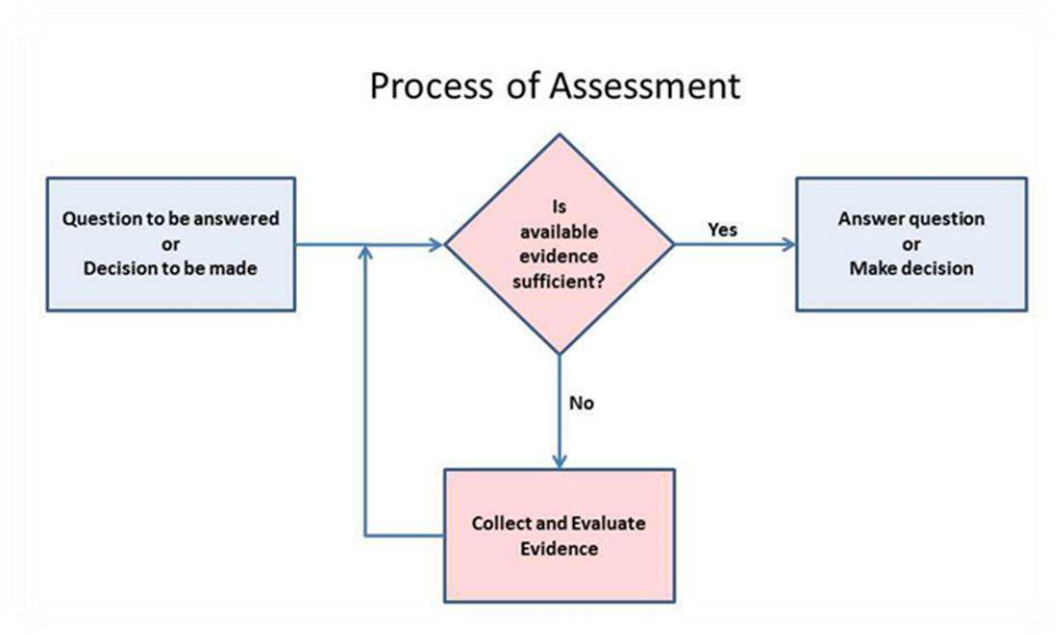

Process of Assessment
Question to be answered
or
Decision to be made
Is
available
evidence
sufficient?
Yes
Answer question
or
Make decision
No
Collect and Evaluate
Evidence

Figure 2

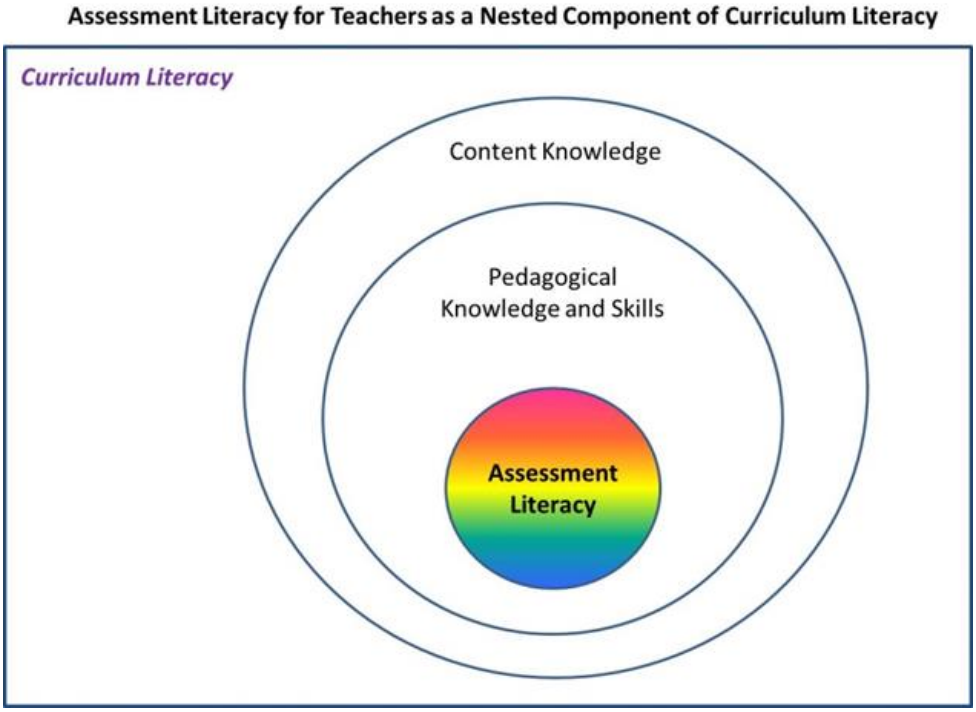
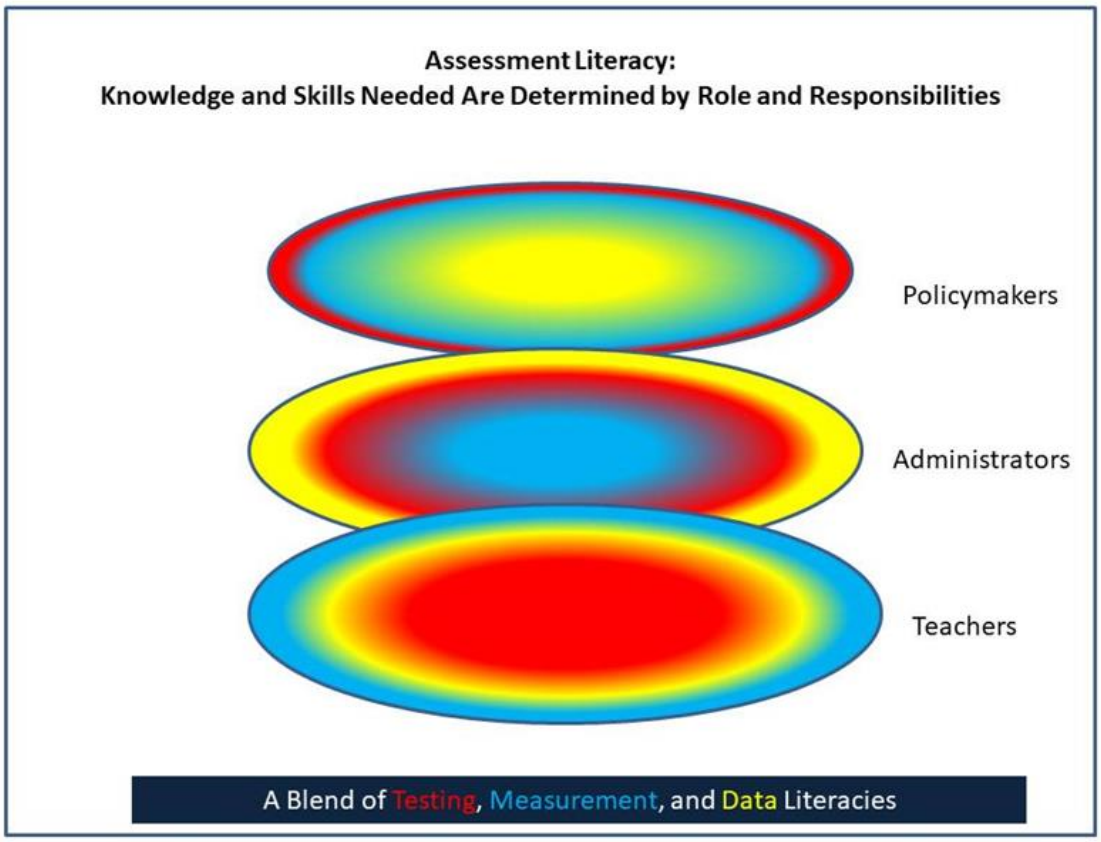

Assessment Literacy for Teachers as a Nested Component of Curriculum Literacy
Curriculum Literacy
Content Knowledge
Pedagogical
Knowledge and Skills
Assessment
Literacy

Figure 3


Assessment Literacy:
Knowledge and Skills Needed Are Determined by Role and Responsibilities
Policymakers
Administrators
Teachers
A Blend of Testing, Measurement, and Data Literacies