Teacher Assessment Literacy: Implications for Diagnostic Assessment Systems

Amy K. Clark
Brooke Nash
Jennifer Burnes
Meagan Karvonen

ATLAS
University of Kansas

Author Note

Paper presented at the 2019 annual meeting of the National Council on Measurement in Education, Toronto, ON. Correspondence concerning this paper should be addressed to Amy Clark, ATLAS, University of Kansas, akclark@ku.edu. Do not redistribute this paper without permission of the authors.
Abstract

Assessment literacy centers on teachers’ basic understanding of fundamental measurement concepts and their impact on instructional decision-making. The rise of diagnostic assessment systems that provide fine-grained information about student achievement shifts the concepts that are fundamental to understanding the assessment system and associated scoring and reporting. This study examines teachers’ assessment literacy in a diagnostic-assessment context as demonstrated in focus groups and survey responses. Results summarize teachers’ understanding of the diagnostic assessment and results; their use of fundamental diagnostic assessment concepts in the discussion; and the ways in which conceptions or misconceptions about the assessment influence their instructional decision making. Implications are shared for other large-scale diagnostic assessment contexts.

Keywords: assessment literacy, diagnostic assessments, instruction, interpretation and use, consequential validity evidence
Teacher Assessment Literacy: Implications for Diagnostic Assessment Systems

Teachers’ assessment literacy has important implications for their interpretation and use of assessment results. As stated by Popham (2011, pp. 267), “Assessment literacy consists of individuals’ understandings of the fundamental assessment concepts and procedures deemed likely to influence educational decisions." Popham emphasized teachers should have at least a basic understanding of these concepts, particularly because large-scale summative assessments also inform accountability decisions that have important implications for state and local policy and in some cases, teachers’ own performance evaluation.

Since the passage of the No Child Left Behind Act, states are required to administer educational assessments for accountability purposes. In addition to inclusion in accountability models, states and districts often use aggregated results for program evaluation and resource allocation purposes. However, despite these uses, many teachers, administrators, and policy makers do not understand what makes an assessment high quality (Stiggins, 2018). Further, large-scale assessment results are typically at too course a grain size to be informative to instruction (Marion, 2018).

Recent flexibility under the Every Student Succeeds Act allows states to depart from the traditional large-scale fixed form summative assessments used to meet accountability requirements. Measurement advancements have led to student-centered assessments such as diagnostic and computer-adaptive measures to be considered for meeting both federal accountability needs while also providing teachers with fine-grained information about what students know and can do. However, in order for these assessments to be instructionally useful, teachers must be able to understand what information the assessment provides them and how to

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1 Italics in original.
effectively use that information to meet students’ instructional needs. In essence, teachers must demonstrate a different type and breadth of assessment literacy than what has been required for traditional summative assessments.

**Assessment Literacy**

Stiggins first introduced the concept of assessment literacy in 1991 to describe the ability of individuals to evaluate the quality of an assessment and determine whether results are in a format that promotes interpretation and use. Brookhart (2011) emphasized that assessment literacy is critical to teachers’ implementation of the *Standards for Teacher Competence in Educational Assessment of Students* (American Federation of Teachers, National Council on Measurement in Education, & National Education Association, 1990) and specifically that “teachers should be able to administer external assessments and interpret their results for decisions about students, classrooms, schools, and districts” (p.7). Further, teachers’ assessment literacy has direct ties to evidence for consequences of testing and the soundness of teachers’ interpretation and use of results (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2014).

Multiple measures exist that may be used to evaluate teachers’ assessment literacy (e.g., DeLuca, McEwan, & Luhana, 2016; Gotch & French, 2014). These measures evaluate teachers’ familiarity with concepts such as assessment purposes, processes, fairness, and measurement theory. Such tools, when used to evaluate the assessment literacy of preservice in or in-service teachers, may provide teacher educators, administrators, or local education agencies with information they can use to improve areas of misunderstanding, particularly if applied to a specific measurement context (e.g., the state summative achievement assessment).
Data Use and Instructional Cycles

As Popham (2011) stated, a key component of being assessment literate is one’s ability to understand assessment concepts and their impact on instructional decision-making. In fact, one of the most widely acknowledged practices to improve student learning is using student data to inform subsequent instruction (Hamilton et al., 2009; Wiliam, 2011). Teachers report that having access to student data impacts their instructional process (Datnow, Park, & Kennedy-Lewis, 2012) and teachers who are more able to effectively use data have a greater impact on student outcomes (Quint, Sepanik, & Smith, 2008). While much of the research into the relationship between assessment data and instructional use has focused on the use of formative assessment tools, diagnostic assessments have emerged as another valuable tool for pinpointing student learning at a fine-enough grain size to support instructional use.

Diagnostic Assessments

A key benefit of diagnostic assessments is their ability to provide fine-grained mastery decisions regarding student knowledge and skills (Leighton & Gierl, 2007). Rather than report a raw or scale score value, diagnostic assessments link each item with attributes, or skills, measured by the assessment via a Q matrix. Results summarize the likelihood that students have mastered those skills or skill profiles, typically in the form of probabilistic values (e.g., using diagnostic classification modeling; Bradshaw, 2017).

While these detailed skill-level mastery profiles are more likely to be informative to instructional practice than traditional raw or scale score values, diagnostic assessments also depart from the traditional, or “basic” assessment concepts as Popham (2011) describes, that teachers are likely familiar with. For instance, terms like “score” and “sub-score” are typically replaced with terms like “skill mastery” and “total skills mastered” in a diagnostic assessment.
context. Teachers may be unfamiliar with how skill mastery is determined or how certain they can be that mastery determinations reflect student’s actual achievement. Similarly, because results are reported as dichotomous mastery decisions, they lack analogous concepts for standard error measurement that is typically reported. For these reasons, diagnostic assessments may challenge the boundaries of teachers’ assessment literacy (Leighton, Gokiert, Cor, & Heffernan, 2010).

As diagnostic assessments become more prevalent and extend beyond research applications to large-scale operational accountability applications, evidence should be collected to evaluate teachers’ understanding of concepts fundamental to diagnostic assessment systems and the implications these understandings have on interpretation of assessment results and subsequent instructional decision-making. Further, as Ketterlin-Geller, Perry, Adams & Sparks (2018) state, “because much of the contextual information [about assessments] is conveyed to test users through score reports, it follows that score reports may be the gate keepers to test users’ ability to understand and interpret data” (p.1).

**Purpose**

We sought to evaluate teachers’ assessment literacy related to a large-scale diagnostic assessment system, from which results are included in statewide accountability models and used to inform classroom instruction. Specifically, we wanted to evaluate how teachers interpreted and used summative score reports in the context of their broader understanding of the diagnostic assessment system. We posed the following three research questions, drawing from Popham’s (2011) definition of assessment literacy. Research questions included:

1. Do teachers demonstrate understanding of the diagnostic assessment system and its results?
2. How do teachers talk about fundamental concepts related to diagnostic assessment?

3. What influence do teachers’ conceptions and misconceptions have on their instructional decision-making?

Methods

Study Context

We answered the research questions in the context of the Dynamic Learning Maps (DLM) alternate assessment system, which consists of diagnostic alternate assessments administered to students with the most significant cognitive disabilities in 19 states. Alternate assessments based on alternate achievement standards measure alternate content standards that are of reduced depth, breadth, and complexity from grade-level college and career readiness standards. DLM assessment blueprints define the alternate content standards for each grade (3-8 and high school) and subject (English language arts, mathematics, and science). For each alternate content standard on the blueprint, students are measured on one or more complexity levels, called linkage levels. There are five linkage levels: the grade-level target, three precursor skills, and a successor skill extending beyond the target. The availability of five levels provides all students with access to grade-level academic content. Prior to test administration, teachers complete or annually update required training. In some districts this is a facilitated (on-site) training, while in other districts teachers complete modules individually via an online portal. Training covers a range of topics, including assessment design, administration, and scoring.

Student responses are scored using diagnostic modeling rather than providing a traditional raw or scale score value. For each assessed linkage level, the scoring model determines dichotomous student mastery (i.e., mastered or not mastered). Results are summarized in individual student score reports, which include two parts: the Learning Profile
(Figure 1) and the Performance Profile (Figure 2). The Learning Profile provides fine-grained linkage level mastery decisions for each assessed standard. The Performance Profile aggregates skill mastery information across (1) sets of conceptually-related standards, shown as the percentage of skills mastered per area, and (2) the subject overall, which uses a standard setting method to place cuts between total linkage levels mastered (Clark, Nash, Karvonen, & Kingston, 2017). Under current assessment administration, some states receive both reports while others receive only the Performance Profile.

Participants

We recruited teachers who had administered DLM assessments and received summative score reports for the prior academic year to participate in focus groups. Eight focus groups were conducted during spring 2018 with teachers from three states across the consortium. Because of attrition challenges between scheduling and conducting phone calls, the number of participants per call ranged from one to five. This resulted in several focus groups being conducted as one-on-one interviews; they are collectively referred to as focus groups for the remainder of the paper. Sessions focused on interpretation and use of the prior year’s summative results in the subsequent academic year. All participants were compensated $50 for their time and contributions.

The 17 participating teachers mostly self-reported as white (n = 13) and female (n = 13). Teachers taught in a range of settings, including rural (n = 2), suburban (n = 9), and urban (n = 5). Teachers reported a range of teaching experience by subject and for students with significant cognitive disabilities, with most teaching more than one subject, and spanning all tested grades. Teachers indicated they taught between 1 (n = 3) and 15 or more (n = 2) students currently
taking DLM assessments, with most indicating they had between 2-5 students taking DLM assessments \((n = 8)\).

**Instruments**

All teachers administering assessments during spring 2018 were assigned a teacher survey. Participation in the survey was voluntary. A total of 19,144 teachers (78.0\%) responded to the survey for 53,543 students, representing all consortium states. Survey items were mix of selected response four-point Likert scale items (strongly agree to strongly disagree) and constructed response.

**Procedures**

A focus group protocol was developed in advance and included questions about interpretation and use of summative individual student score reports in the subsequent academic year. At the beginning of each focus group, the facilitator reviewed informed consent and indicated the focus group would be recorded. Focus groups followed a semi-structured format that included questions from the protocol as well as probing when additional topics emerged from the participant discussion. Focus groups lasted approximately 90 minutes. Audio from each focus group was transcribed verbatim by an external transcriber for subsequent analysis.

Teacher surveys were delivered during the spring 2018 DLM test administration. Teachers completed one survey per student. Surveys were spiral assigned across students, with forms covering a range of topics, including the teacher’s experience using the system and administering assessments, which informs research question 1.

**Data Analysis**

We used focus group transcripts to answer the three research questions. Researchers used an inductive analytic approach to identify and define codes while refining the coding scheme as
needed to gain an accurate representation of the contents of the transcripts. We developed an initial set of codes and definitions from the themes that emerged after an initial reading of transcripts as well as codes developed from knowledge of the current research literature. We applied these codes to one transcript and then met to discuss and reconcile any differences. We then refined the coding scheme, coded one more transcript, and again met to discuss and reconcile. No further changes were made to the coding scheme. The final coding protocol resulted in 18 codes across three categories. Researchers independently coded the remaining six transcripts. Final codes were applied to transcripted text using Dedoose qualitative data analysis software, and transcript-excerpts retrieved by tagged research question.

Teacher survey data was compiled following the close of the assessment window. Descriptive summary information was provided for each item and combined with focus group findings for research question 1.

Results

Findings are summarized for each research question.

Understanding of Assessment and Results

Focus group participants generally described the assessments and score reports in ways that reflected an understanding of assessment system design and administration. They described being comfortable administering assessments and familiar with the contents of assessment blueprints (i.e., what the assessment measured and at what grain size). Similar findings were observed in the teacher survey data. Teachers agreed or strongly agreed that they were confident administering DLM assessments (97.0%), that required test administrator training prepared them for administration responsibilities (91.2%), that manuals and resources helped them understand
how to use the system (91.0%) and that the brief summary documents accompanying each assessment helped them with delivery (90.1%).

Despite this understanding of the system overall, all teachers participating in the focus group indicated a desire for additional training and resources, specifically focused on understanding the assessment results and using results to plan subsequent instruction. Teachers who received local training indicated that it often prioritized assessment administration and did not provide them with information they needed to understand score reports or how to use them to inform their instructional practice. One teacher described her first year with the assessment system using the adage “drinking from a firehose” to describe the flood of information training covered.

Being that first year, in a firehose scenario, [the score report] wasn’t very meaningful. I didn’t get a lot out of it. I wasn’t able to give the parents a lot out of it other than, ‘Here’s your score report. It’s color-coded so you can see where your kid [mastered skills].

The teacher went on to describe how she knew there had to be more she could get out of the report and went to the assessment website to find additional resources. Only then did she feel confident discussing results with parents in a way that reflected a deep understanding of the assessment system, the results, and how both the system and results connected to her instruction and the student’s IEP goals.

When discussing the score reports specifically, teachers’ statements during focus groups generally reflected comprehension of intended meaning. Participants described looking at the Learning Profile (Figure 1) to understand the specific skills students had demonstrated. They correctly understood the shading on the report, which indicated linkage levels mastered, not mastered, or not assessed, and incorporated that language into their discussion. When describing the aggregated information on the Performance Profile (Figure 2), teachers correctly indicated it provided overall summary information for the subject, although many also made statements
about the student’s overall “score” when referring to the performance level or their “score” on specific standards despite the absence of quantitative values. Some teachers mistakenly interpreted bar graphs on the Performance Profile that summarize the percent of skills mastered, incorrectly describing the results as the percentage of items the student correctly responded to or the percentage of trials in which the student demonstrated a behavior.

**Diagnostic Assessment Concepts**

During focus groups, teachers were comfortable using the term “mastery” to describe student performance on specific skills measured by the assessment. Several teachers explained that they preferred the DLM assessment to previously administered assessments because it provided them with information about exactly what students have and have not mastered. One teacher further believed that the diagnostic skill-mastery information made it is easy to see how students progress as they master more and higher-level skills.

However, it was also clear from the teacher discussions that they were unsure how mastery was actually determined or defined. Two teachers explicitly expressed more-traditional definitions of mastery to mean demonstrating the skill with at least 80% accuracy, or four out of five trials as an example. Others explained that mastery determination is “a very complex thing” and that they do not understand what happens after assessment administration that results in mastery decisions. One teacher referred to the scoring process as a “black box”. These misconceptions in how mastery is defined and determined may also lead to some teachers’ lack of trust in the results that they receive. One teacher wondered if the mastery results for some of her students were based on a “lucky guess.” Conversely, other teachers believed that the mastery results reflected what students were learning more accurately than previous alternate
assessments. One teacher stated that DLM “is a more honest assessment of where students stand.”

**Instructional Use**

Teachers’ conceptions of mastery in the previous section may have played a role in how they approached instruction, although they did not explicitly describe it as such. Teachers generally accepted the mastery determinations as true and placed a high-degree of trust in the results when planning next steps for instruction, perhaps because of their beliefs for how it was determined. As one teacher stated when talking with another teacher about the results,

> I told him, “I want you to look at those reports and see if you really feel like that that is a reflection of where that student is.” And he looked at it, and he said, ‘Absolutely. That's absolutely amazing.’ You guys are right on target when it comes to the shaded areas on where the students truly are. I think it's a very good match. With the portfolio [alternate assessment], you didn't get near what we get with this.

Teachers did not tend to question the results or indicate that the values reflected probabilities of mastery rather than absolute determinations about what the student definitely knows and can do as demonstrated by their responses to assessment items. This may have been due to the above descriptions of mastery being mistakenly perceived as percent correct or percent of trials.

Regardless of their conceptions for how mastery was calculated, the mastery shading played an important role in shaping subsequent instruction. Teachers explained that the skill-level mastery information was beneficial for setting up instructional plans that aligned to students’ learning progress. This belief strongly influenced their use of results. One teacher stated that, “without it, I’m not sure how I could educate students because I wouldn’t even know where they are at.” Several teachers referred to using the reports to identify gaps in students’ skills that should be the focus of subsequent instruction. Having the fine-grained information for each content standard helped teachers know which levels or skills to work on next towards grade-level proficiency in the same content strands. Teachers varied in prioritizing greater depth
in a particular content strand or wider breadth across the content standards based on students’ prior performance.

Teachers also expressed that the mastery information in score reports served as a useful guide for planning student IEP goals. One teacher stated, “I look at what they scored last year in each subject area and what the gaps are and that’s the areas that we’re going to focus on this year academically.” When score reports identified areas that were lacking, teachers would target IEP goals and objectives to these areas. One stated, “I really feel like this holds kids to a higher standard. I think it keeps teachers from writing copout goals. And it makes them do more. What can they really achieve?”

While not a prominent discussion point, teachers also noted that they found the fine-grained assessment results useful in talking with parents about the score reports. The skill mastery information provided teachers with more information and additional context for describing what their child had been working on and the skills they attained.

**Discussion**

Teachers’ assessment literacy has important implications for their interpretation and use of assessment results. Particularly for diagnostic assessment systems, which are relatively new and differ from traditional large-scale summative assessments, it is imperative for assessment designers to foster and evaluate stakeholders’ assessment literacy because of the differences in some of the fundamental aspects of the assessment. This includes ensuring educators are provided needed resources to understand, evaluate, and apply diagnostic assessment results to improve students’ educational outcomes, even into the subsequent academic year.

The present study identified several areas of promise and pitfalls concerning teachers’ assessment literacy when describing diagnostic assessments and their results. Teachers used the
term “mastery” with ease and did not describe any challenges associated with understanding or using the fine-grained skill information. Teachers appeared to understand the use and benefits of the profiles of skill mastery resulting from diagnostic assessment. However, further probing indicated a lack of understanding regarding how mastery decisions were made. Teachers did not describe mastery decisions as being based on probability values or make statements about the degree of certainty that must be reflected for a skill to be classified as mastered. One teacher’s expression of the results perhaps being a “lucky guess” may reflect the teacher’s misconceptions about her own students’ capability to attain academic skills; it also demonstrates that the misconception that guessing (and slipping) is not accounted for in both the assessment design and statistical model used to derive mastery statuses.

Part of the challenge to assessment literacy for diagnostic assessments may be due to “mastery” being such a common term that teachers’ already have some familiarity with, which could affect both their conceptions and misconceptions. To the extent that the operational definition of mastery differs from teachers’ conceptions of how students demonstrate mastery (e.g., percentage of correct item responses, percentage of trials – which is common in special education instruction that uses massed trials), results may actually be more challenging for teachers to understand and use. This is contrasted with traditional assessment approaches with scaled scores as numeric values; while teachers may similarly not understand how a scaled score is calculated, because the terminology differs from words used to describe student achievement in their classrooms it may be accepted as-is and without the same confounding of terms. Teachers’ prevalent use of “score” to describe student performance on diagnostic assessments despite the absence of a numerical value describing performance may also reflect some reliance on their broader assessment literacy and traditional conceptions of reporting.
These findings along with teacher statements point to a clear need for making assessment and reporting resources readily available to teachers. While the DLM Consortium makes several resources available to teachers to help their understanding of the scoring model, including how mastery is determined, further exploration may be needed to bridge the gap between contents of available supports and teachers’ gaps in understanding. Materials could also be made available to district staff to support professional development that broadens the current teacher-described focus on administration to also include reporting and use of results. By providing materials targeted at potential misconceptions and making them easily accessible, the information may support teachers in becoming more literate on the assessment system, what it measures, what results mean, and how results can be used to inform subsequent instruction. However, it is also important for test developers to determine how much assessment literacy is “enough” to support adequate interpretation and use of results; there may be a fine line between too much information and not enough.

Overall, evidence from the focus groups and teacher survey indicates support for the utility of diagnostic assessment and teachers’ decision-making from student results. Teachers emphasized the importance of having fine-grained information to inform instructional practice and its utility for informing IEP goals and parent communication. By understanding how teachers approach diagnostic assessments and associated reports, we can better evaluate their assessment literacy and meet their needs to ultimately improve student outcomes.
References


Student’s performance in 10th grade English language arts Essential Elements is summarized below. This information is based on all of the DLM tests Student took during the 2017-18 school year. Grade 10 had 19 Essential Elements in 4 Conceptual Areas available for instruction during the 2017-18 school year. The minimum required number of Essential Elements for testing in 10th grade was 10. Student was tested on 17 Essential Elements in 4 of the 4 Conceptual Areas.

In order to master an Essential Element, a student must master a series of skills leading up to the specific skill identified in the Essential Element. This table describes what skills your child demonstrated in the assessment and how those skills compare to grade level expectations.

<table>
<thead>
<tr>
<th>Area</th>
<th>Essential Element</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4 (Target)</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA.CT.2</td>
<td>ELA.R.9-10.4.a</td>
<td>Identify familiar objects through properly word descriptors</td>
<td>Identify definition of words</td>
<td>Identify missing words using sentence context</td>
<td>Use semantic clues to identify word meaning</td>
<td>Use semantic clues to identify phrase meaning</td>
</tr>
<tr>
<td></td>
<td>ELA.R.9-10.5.b</td>
<td>Draw conclusions from category knowledge</td>
<td>Identify multiple meanings of a word</td>
<td>Identify word meaning of multiple meaning words using context clues</td>
<td>Identify the intended meaning of multiple meaning words</td>
<td>Understand how multiple meaning words can exist in humor</td>
</tr>
<tr>
<td></td>
<td>ELA.R.9-10.6</td>
<td>Identify concrete details in a familiar informational text</td>
<td>Identify concrete details in an international text</td>
<td>Cite textual evidence for explicit and inferred information</td>
<td>Cite evidence for a text's specific meaning</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1.** The Learning Profile portion of individual student score reports indicates skills mastered for the five complexity levels available for each “Essential Element” content standard.
Figure 2. The Performance Profile portion of individual student score reports includes the performance level for the subject, performance level descriptors describing skills typical of students achieving at that level, and conceptual area bar graphs summarizing the percent of skills mastered in each area of related standards.