Guidelines for the Development of American Sign Language Versions of Academic Test Content for K-12 Students

February 2015

This document was produced by the Measured Progress Innovation Lab and Maryland State Department of Education with funding from the U.S. Department of Education.

The contents of this document were developed under an Enhanced Assessment Grant (#S368A120006) from the U.S. Department of Education. However, the contents do not necessarily represent the policy of the U.S. Department of Education, and you should not assume endorsement by the Federal government.
What is GAAP?

The Guidelines for Accessible Assessments Project (GAAP) is a federally funded effort led by the Maryland State Department of Education and the Measured Progress Innovation Lab, working in conjunction with 17 partner states, the National Center for Educational Outcomes (NCEO), WGBH’s National Center for Accessible Media (NCAM), and national accessibility experts and educators to develop research-based guidelines for the representation of test items in audio and American Sign Language (ASL).

The Guidelines for the Development of American Sign Language Versions of Academic Test Content for K-12 Students (referred to throughout this document as GAAP ASL Guidelines) are intended to aid state departments of education, assessment consortia, and test vendors in creating standardized ASL versions of test items. The aim of the guidelines is to ensure that ASL versions of test items provide quality access to students who use ASL to communicate and/or learn content in the classroom, while still measuring the same construct as is measured in the English text version of the assessment. The GAAP ASL Guidelines are accompanied by example items (available at http://gaap.measuredprogress.org/gaap/) created by the GAAP ASL Working Group, a team with collective expertise in assessment, accessibility, instruction, content and academic standards, and ASL.

The GAAP ASL guidelines and example items were developed through an iterative process of research and development. Preliminary guidelines and ASL test items were developed and informed by 1) a review of existing assessment sign support and accommodation research; 2) a review of existing state sign language guidelines for assessment; 3) interviews with staff members in two states (Massachusetts and South Carolina) that currently develop a signed version of state assessments on DVD to accompany paper-based test materials; and 4) expert review and discussion of the literature, existing guidelines, and existing state practices. The draft ASL versions of test items were evaluated through two rounds of research with ASL users across the country: a series of cognitive labs followed by a randomized controlled trial. The research was conducted using a computer-based testing system where both the English text version of the item and the ASL version of the item (a video of a human signing the item) were available to students. The research findings were used to inform revisions of the GAAP ASL guidelines.

Additional information about the GAAP project is available on the project website (http://gaap.measuredprogress.org/gaap/). The website contains information about the project, example ASL versions of test items, a video ASL version of this document, and a white paper and brief summarizing all GAAP research and development with implications of research findings.
# Table of Contents

What is GAAP? .................................................................................................................................................. 2  
Acknowledgements ....................................................................................................................................... 4  
Section One: Frequently Asked Questions ........................................................................................................ 5  
Section Two: ASL Item Development Team ........................................................................................................ 6  
Section Three: ASL Item Development Process ............................................................................................... 9  
Section Four: ASL Guidelines ............................................................................................................................. 11  
  ASL Grammar Guidelines ............................................................................................................................... 12  
  Content Guidelines ......................................................................................................................................... 14  
  Considerations for Technology Enhanced Item Features ................................................................................ 17  
Section Five: ASL Filming Considerations .......................................................................................................... 18  
Appendix A: GAAP ASL Working Group Team Member Biographical Sketches ................................................ 19  
References ......................................................................................................................................................... 21  
Endnotes ............................................................................................................................................................ 24
Acknowledgements

- Lead State: Maryland State Department of Education (Trinell Bowman, Project Director)
- Project Management/Research Partner: Measured Progress Innovation Lab (Lisa Famularo, Jennifer Higgins and Rachel Hall)
- Evaluation Partner: National Center on Educational Outcomes (Laurene Christensen and Vitaliy Shyyan)
- ASL Working Group*: Jeanne Reis, Christopher Kurz, Lori Moers, Stephanie Cawthon, Mark Johnson, Lisa Famularo, Jennifer Higgins, Rachel Hall
- GAAP Advisory Board Members: Betty Colonomous, Cara Laitusis, Steve Sireci, Deborah Willis, Lynn Shafer-Willner, Cindy Volk
- As part of the review process, PARCC, Smarter Balanced Assessment Consortium, and several state Department of Education and state School for the Deaf representatives provided feedback on the draft GAAP ASL Guidelines. The feedback was used to inform updates and revisions, which are incorporated in this document.

* See Appendix A for ASL Working Group team member biographical sketches.
Section One: Frequently Asked Questions

What is American Sign Language? American Sign Language (ASL) is one of many signed languages used around the world, the natural signed language commonly used in the United States. The development of ASL, like English, has arisen through use rather than by prescription.\textsuperscript{iv} Shared by Deaf and Hard of Hearing (DHH) people in the United States and many parts of Canada, American Sign Language (ASL) is a visual-spatial language with its own unique grammar and syntax. “With signing, the brain processes linguistic information through the eyes. The shape, placement, and movement of the hands, as well as facial expressions and body movements, all play important parts in conveying information” (National Association of the Deaf, 2014). With the exception of fingerspelling, ASL is not based on the grammar or vocabulary of English.

Who uses ASL to communicate? In the United States, individuals who are deaf or hard of hearing along with their parents, children, family members, friends, and interpreters use ASL to communicate with one another. In addition, growing numbers of people more peripherally connected to the Deaf Community, such as students taking courses in ASL, colleagues and many others, learn ASL in order to communicate with the extended community of signers.\textsuperscript{ii} More recently, some hearing parents, many with no connection to the Deaf Community, have found that ASL use in the home fosters early language development for infants, who are often able to express themselves through signed language much earlier than through spoken language.

This report focuses on a subset of the total population of ASL users, K-12 students who are deaf or hard of hearing,\textsuperscript{vii} who will be referred to in this document as *deaf* or by the acronym DHH. Like any group of students, students who are DHH are diverse in terms of physical, cultural, home, and academic backgrounds.\textsuperscript{v} However, because of the unique social, political, economic, and geographic realities that impact language input and choices available to DHH children,\textsuperscript{vi} their language learning and resulting proficiency in ASL and English can be highly variable.

Why should tests be provided in ASL? Administering standardized tests in the English language may create a barrier that prevents students whose primary language is ASL from fully demonstrating what they know and what they can do.\textsuperscript{vii} This consequence runs counter to the purpose of standardized assessment, which is to provide accurate, valid, and reliable measures of student achievement.\textsuperscript{vi} More than 90% of children who are DHH are born to hearing parents.\textsuperscript{viii} In most cases, hearing parents do not have robust sign language skills and are not able to fully communicate with their child in either ASL or spoken English.\textsuperscript{ix} Deaf children who are not provided with ASL input from birth or at a very early age are considered late first language learners (Mayberry, 2002). Delayed access to a first and fully accessible language impacts fluency with all academic content, such as mathematics, science, and social studies, as well as some underlying cognitive skills. Lack of a first language also has implications for children’s learning of English as a second language in print form, an important skill for all students.\textsuperscript{x} As a result, DHH students enter school with a wider range of English proficiency than their peers. Additionally, in some school settings ASL is the primary language of instruction for DHH students. These students are taught both the content assessed on state and consortia tests, and English as a second language, in ASL. Some schools use sign systems other than ASL during instruction (e.g. Signed Exact English and Conceptually Accurate Signed English). The GAAP ASL Guidelines are specific to ASL and should only be used to create versions of test items for students who communicate and/or receive instruction in ASL.

Are there problems with live ASL interpretation of tests? Yes. Live ASL interpretation, sometimes referred to as “translation on the fly,” may result in inconsistencies in the delivery of test content meant to be presented to students in a standardized way.\textsuperscript{xi} Inconsistencies occur, in part, because the sign interpreter or “live translator” typically has limited or no time to review the test in advance and thus, is faced with the challenge of how to represent the same content and amount of information presented in the English version of the test to the student in ASL “on the fly.” Live translators and interpreters are highly unlikely to have a background in assessment or be familiar with the principles underlying testing and measurement. Regional variations and “dialects” of a language also lead to inconsistencies in the delivery of test content. Furthermore, there are no
mechanisms in place to ensure the accuracy and appropriateness of live translations of test items. In other words, there are no mechanisms for ensuring that live translation provides quality access for the student and a representation of the item that measures the same construct as is measured in the English test version. Moreover, students often will not ask for repeated translations of test items, and those rare students who do may see the same item presented differently each time, due to the nature of live translation. While inconsistencies exist whenever an educator or other person (e.g., sign interpreter, human reader, scribe, etc.) provides an item translation or another type of accommodation, sign interpretation is particularly problematic due to the lack of well-trained and highly skilled educational interpreters. Recent research on interpreter quality suggests that more than half of all DHH students are assigned interpreters with inadequate skills to provide full access to academic content in the classroom. This means that students assigned to a less qualified interpreter during assessment have a disadvantage compared to students assigned to a highly qualified interpreter. In sum, these factors contribute to a substantially different experience for DHH students taking standardized tests via ASL “translation on the fly,” an experience that deviates significantly from standardized test design principles and may result in an inaccurate measure of DHH students’ knowledge.

In an era of computer-based testing, how can ASL support be provided to students who need it? Recent advances in technology standards and computer-based testing make it possible to embed videos in a test delivery system, allowing the English test item and a video of the ASL version of the test item to be displayed simultaneously. With this online delivery system, students can read the English test item, view the video of the ASL version of the item, and replay the entire ASL item or portions of it. This approach is often referred to as “embedded video sign support.” The design allows each student to individually decide how to access the test content in a way that best fits his or her needs. Embedded video sign support created using GAAP ASL guidelines will ensure high-quality ASL versions of test content are delivered to students in a standardized and equitable manner.

Section Two: Recommended Qualifications for ASL Item Development Team

In order to ensure that English test items are represented in ASL in a clear and standardized way that does not violate measurement constructs, it is important to engage with qualified experts to form a multi-disciplinary team. Creating high-quality ASL interpretations of test items requires collective expertise in multiple areas, including ASL, the grade level and content area being assessed, educational assessment and measurement, and quality video production. Below is a summary of key team members and their qualifications:

**Deaf Content Expert and Educator:** A deaf content expert who is also an educator with native ASL fluency is needed to co-lead the development of the ASL representations of item content and to serve as the signer/actor in the ASL videos. The GAAP team strongly recommends that an educator who is deaf fill this role. This person must have a college degree in education with a bachelor’s or master’s degree in the content area being tested. He or she should also have experience teaching DHH students at the grade level being assessed, familiarity in content at least one grade level above what he/she has taught, and a strong understanding of the state/consortia standards that are being assessed. Furthermore, this person should be a native user of ASL with experience in instruction using ASL as the primary language modality. The GAAP team recommends diversity in signer gender and ethnicity if possible, but most importantly prioritizes the requirement that the signer is a native user of ASL, and has a track record for providing high-quality instruction to DHH students using ASL. In order to maintain consistency in test delivery, the GAAP team recommends using the same signer across items and content areas for a given grade level. In developing items for GAAP research, Chris Kurz (National Technical Institute of the Deaf at the Rochester Institute of Technology) filled the deaf content expert and educator role.
**English-ASL Bilingual Specialist and Interpreter:** An English-ASL bilingual specialist who is also an experienced interpreter is needed to co-lead the development of the ASL representations of item content and to serve as the interpreter for the signer/actor in the ASL videos. The GAAP team strongly recommends that the English-ASL bilingual specialist have expertise in interpreting for educational assessment. He or she should hold a bachelor’s or master’s degree, and be nationally certified, meeting RID and/or EIPA standards for expertise (4.0 or higher). Jeanne Reis (interpreter in private practice and Boston University ASL STEM Project Manager) filled the English-ASL bilingual specialist and interpreter role in developing GAAP items.

**Content Specialist:** A content specialist is needed to ensure that the ASL versions of test items are linguistically and academically correct from a content perspective and measure the same construct as is measured in the English text version. The content specialist must have teaching and item development experience in the content area and grade level being assessed and a strong understanding of the state/consortia standards. It is not necessary for the content specialist to be an ASL user. As described later in this section, interpreters facilitate discussion during item development and ASL versions of test items include voice-interpretation to enable review by non-ASL users. This role could be filled by a staff member from either the state department of education/consortia or the assessment vendor, or someone hired as an independent contractor who possesses the specified qualifications. Mark Johnson (Measured Progress) filled the content specialist role in developing GAAP items.

**Assessment and Accessibility Specialist:** An assessment and accessibility specialist is needed to ensure the ASL versions of test items are accessible and understandable from a test-taker’s perspective and that the ASL versions measure the same construct as is measured in the English text version. The assessment and accessibility specialist must have training and experience in educational assessment and measurement, specifically a thorough understanding of issues related to test reliability and validity for students using access and accommodation supports. It is not necessary for the assessment and accessibility specialist to be an ASL user. As described later in this section, interpreters facilitate discussion during item development and ASL versions of test items include voice-interpretation to enable review by non-ASL users. This role could be filled by a staff member from either the state department of education/consortia or the assessment vendor, or someone hired as an independent contractor. The number of assessment and accessibility specialists should be based on the scope of work. GAAP was a large research and development project that included two research studies as well as the development of guidelines and ASL versions of test items. In addition to serving as project managers and researchers, Measured Progress Innovation Lab staff members Lisa Famularo, Rachel Hall and Jennifer Higgins filled the role of assessment and accessibility specialists on the ASL item development team. Stephanie Cawthon (The University of Texas at Austin), a researcher who specializes in research among DHH students, also served as assessment and accessibility specialist. Future ASL item development teams will likely not require as many participants in this category as GAAP.

**Video Production Specialist:** Video production specialists are needed to produce high quality ASL videos that can be embedded into a computer-based testing system. The video production specialist must have prior experience with developing ASL videos and follow the GAAP equipment and set-up guidelines (backdrop, lighting, etc.). Atlantic Media Productions filled the video production specialist role in producing items for GAAP.

**Team Interpreters:** In addition to the roles defined above, a team of two or more interpreters is needed to facilitate communication during meetings and video production activities. We recommend the size of the interpreter team be based on the number of hearing participants who do not communicate in ASL, and the number of deaf participants. The interpreters should have experience with K-12 education settings, and ideally knowledge of assessment and ASL linguistics.
**ASL Linguist:** The GAAP ASL Item Development Team included an ASL specialist who was also a deaf educator and was trained in the linguistics of ASL. The ASL specialist assisted the deaf content educator with translations. When budget allows, the GAAP team recommends the inclusion of an ASL linguist in ASL item development. Lori Moers (Maryland School for the Deaf) filled the ASL linguist role for GAAP.

The table below summarizes the recommended qualifications of each team member.

**Summary of Key Qualifications for ASL Item Development Team Members**

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Degree in Education</th>
<th>ASL</th>
<th>Content</th>
<th>Standards</th>
<th>Assessment</th>
<th>Accessibility</th>
<th>ASL Video Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaf Content Expert &amp; Educator</td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>English-ASL Bilingual Specialist and Interpreter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content Specialist</td>
<td></td>
<td>★</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Assessment Accessibility Specialist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Video Production Specialist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

**Key:**
- ★ Expertise
- ● Understanding
- + Required
The number of people in each of these roles is dictated by the number of test items/tasks and the timeframe for production. Each team member brings important expertise that is essential in developing high quality ASL videos. Team interpreters are not listed in the above table as they are not directly involved in the ASL item development process; they do however play a critical role in facilitating communication between ASL users and non-ASL users, and consistency in this team is very helpful. Because team dynamics and consensus decision-making are important characteristics of a good team, ideally there would be continuity in team members from year to year. Written documentation of decisions made by the team will also serve to ensure consistency across different ASL item development phases. The ASL Linguist is not listed in the above table since budget should dictate filling this role.

Section Three: ASL Item Development Process

The process of developing high quality ASL representations of test items consists of five main steps: preparation, item drafting, video production, review and revision, and research and evaluation. The steps summarized below are based on lessons learned over the two years that the GAAP ASL Team members worked together, including team discussions and thinking critically about the process. Modifications to this process may be necessary for future ASL assessment development teams based on unique group dynamics, task demands, or other contextual factors.

Prior to the start of ASL item development, a decision must be made regarding how to handle content-specific terminology for which there are no widely recognized ASL signs. We recommend that assessment program staff and the item development team work together to determine whether the team should develop an ASL glossary of linguistically appropriate content signs or adopt an existing glossary. We recommend that glossary development occur prior to ASL item development and the final glossary be made available to students and teachers for review prior to assessment. It is important to note that since the content-specific terms included in the glossary may not be widely recognized, when used as part of assessment, the terms should also be fingerspelled to aid comprehension.

Preparation: In order to prepare for creating the ASL videos, the entire team must review all test items. The team must discuss approaches that will ensure that the ASL versions of the items represent the content presented in the English text without changing what is being measured or the meaning. To accomplish this, we recommend that the team meet in person and work through the assessment item-by-item. For each item, the team must carefully consider and determine the meaning and the construct being measured. In addition, they must analyze the lexicon, the grammatical structure, and the cultural context. Following this, the group must reconstruct the same meaning and measure the same construct using the lexicon and grammatical structure of ASL. As part of the process, the team must consider how to apply the GAAP ASL guidelines and discuss how to address any potentially controversial interpretation issues. More specifically, decisions need to be made in order to balance the most linguistically and academically correct representation from a content perspective with the most accessible and understandable representation from a test-taker’s perspective. Linguistic elements such as verb directionality, noun/pronoun structure, item set-up, perspective, use of space, fingerspelling, plurality, and dimensionality should be discussed and decisions documented for later reference (see Section Four for more information on these topics). This documentation will serve as the basis for drafting and recording ASL drafts of a subset of items.

The GAAP project team conducted this preparation step through in person meetings and found it extremely valuable to have face-to-face discussions. State and consortia ASL item development teams should consider project budgets and logistics in deciding whether preparation should be conducted in-person or remotely using tracking documents and collaboration technology such as Adobe Connect, GoToMeeting, or Google Hangout.

Item Drafting: Based on the preparation discussions and documented decisions, the team should identify a subset of items for which draft ASL representations will be created. The purpose of creating draft ASL representations is to enable each team member to review the items that will likely require extended discussion
prior to video production. This step increases the efficiency of the in-person video production session by allowing progress and documentation of ideas before the group meets in person. To this end, the subset of items should include a variety of item features, text complexity, and items that in the preparation stage were identified as challenging for ASL interpretation. The deaf content expert/educator and bilingual specialist/interpreter then create ASL drafts of each identified item, with the deaf content expert/educator signing the items and the bilingual specialist/interpreter narrating the ASL translation in spoken English, explicitly noting how the ASL item differs from the English version, whether in structure, presentation, or other aspects. This process can easily be done using an iPad or other mobile device. The drafts are then posted on a secure website. Each team member individually reviews the items, making note of any concerns with the translation. Note that the ASL-English narration is included to enable team members who are not fluent ASL users to review the video drafts, and is not included in the ASL videos delivered to students.

**Video Production:** All team members meet in person to discuss any concerns they have with the draft ASL representations of the items. At this point in the process all high level issues (such as approach, set-up, identifying words to be fingerspelled, etc.) should have been agreed upon. Any issues that arise in the production step are more nuanced (e.g., ensuring that both hands are visible at all times), minor in significance (e.g., re-fingerspelling a proper name versus referring to “the boy” after the character has been introduced), or were over-looked in preparation. After discussions are complete, the team works with a video production team to create high quality ASL videos. It is important that the bilingual specialist/interpreter’s spoken English narration of the items be included with the video files so that during the production step of associating video files with text-based items, people who may not be fluent ASL users can ensure that the correct video is affiliated with the correct test item. The video production company then performs post-production activities (editing, file creation, etc.).

**Review and Revision:** Once the production team has completed their first cut of the ASL videos, it is important to review the products and, if needed, revise the items before they are considered complete. We recommend that all items be reviewed by a native ASL educator and a content area specialist who were not a part of the original item development process. The items should be reviewed in the format that will be used for delivery to students; that is the English text item with embedded ASL video. Content area specialists who are not ASL-users will listen to the spoken English narration of the item in addition to viewing the English text item with embedded ASL video. Both the native ASL educator and content specialist should review the items to ensure that the ASL versions of the items represent the content presented in the English text version of the item. Specifically, reviewers should consider the amount of information presented in each item. If too little information is presented, the item may not provide DHH students with appropriate access. Too much information may be a distraction to test-takers or provide an unfair advantage. They should also ensure that the GAAP ASL Guidelines are followed in each ASL item. The ASL educator will also ensure that signing, including facial expressions, is clear and pacing is appropriate; that content vocabulary is signed whenever possible, even if the vocabulary is novel and/or not widely known, in order to support full comprehension; and that regional or novel signs that may not be familiar to students across different geographical areas are paired with a fingerspelled English translation of the sign. (As previously mentioned, it is our recommendation that an ASL glossary of linguistically and conceptually appropriate content signs that may appear on the assessment be made available to students and teachers for review prior to assessment.) If a reviewer has major concerns about how the content is represented in ASL, he/she can recommend changes and suggest re-recording the video. The reviewers will also document overall thoughts and recommendations for recording ASL versions of items going forward.

**Research and Evaluation:** Ongoing research and evaluation should be conducted to ensure that 1) the ASL versions of the test items are facilitating access to test content for students whose primary language is ASL and 2) the ASL representation has not changed the intended measurement construct. This research should be conducted one-on-one with students using a think aloud cognitive lab, cognitive interview or similar approach whereby a researcher observes and records information about a student’s experience as he/she completes a practice test with embedded videos of ASL versions of the test items. During think aloud cognitive labs, the
student is asked to explain his/her thinking process as he/she responds to each item. This “thinking aloud” allows the researcher to determine whether the student is able to access the content and whether the item is eliciting the targeted knowledge, skills and abilities. During cognitive interviews, researchers use structured prompting to guide students in articulating their thoughts. This approach involves a structured set of interview questions targeting issues of concern to the researcher. For example, the researcher might ask the student to explain his/her understanding of the item or task, describe problems he/she may have had with the item, elaborate on how he/she obtained his/her answers, or anything else that may shed light on the broader circumstances that influenced his/her ability to access the content and/or demonstrate his/her knowledge, skills and abilities. Information from the research should be used to make revisions to the GAAP ASL Guidelines and the subsequent ASL videos of assessment content.

Section Four: ASL Guidelines

When the language of an assessment changes, it raises concerns about the validity of inferences made from the test scores. For the purpose of this discussion, translations from English are only undertaken when the construct of interest is something other than the student’s proficiency in reading and using English. In order for test scores on translated tests to be comparable with those from assessments administered in English, it is imperative that the translated test items represent the content presented in the English text in a way that does not change what is being measured. Maintaining the meaning of the test item does not entail a literal or direct word for word translation of the English text into the other language; in fact, this is highly likely to alter the original meaning. Rather, the translation must convey the same essential meaning of the original text while also adhering to the linguistic rules and conventions of the language into which the items are being translated. In order for the translated test to be fair and lead to valid conclusions about student proficiency in the target content area, the translation should not alter the constructs measured by the item, lead or cue students to a particular response, or give an unfair advantage or disadvantage to the students who receive the translated version over students who receive the English version. As was mentioned in section 2, the ASL linguist can assist the deaf content educator with such translations.

The purpose of the GAAP guidelines is to provide specific information on how to achieve this balance of conveying the construct in a manner that reflects the linguistic rules and conventions of ASL while at the same time maintaining the essential meaning of the item. This section contains guidelines on three important topics in ASL test item development: ASL Grammar, Content Guidelines, and Guidelines for Technology Enhanced Item Features. ASL versions of test items that illustrate these guidelines across three grade level bands are available online at http://gaap.measuredprogress.org/gaap/.

- The ASL Grammar Guidelines section highlights key grammar rules that should be reviewed and considered for incorporation in all items. For English text items, states and consortia often detail English grammar requirements in style guides that item writers use as one of several inputs to the development process. For example, the Smarter Balanced Assessment Consortia style guide contains a grammar section that lists guidelines for subject-verb agreement, pronoun-antecedent agreement, modifiers, and adjectival and adverbial degrees. No state or consortia currently has ASL Grammar guidelines for test content available. This section of the GAAP ASL Guidelines is an initial step to fill this need.

- The Content Guidelines section presents findings and insight from GAAP research and pertains to items that contain particular types of content (e.g. equations, graphics). The content studied in GAAP was identified through team discussion, review of existing state guidelines and practices, and interviews with staff in states that currently create ASL DVDs of test content (Massachusetts and South Carolina).
The Guidelines for Technology Enhanced Item Features section reviews features of newer item types that students may be less familiar with and offers guidance on how these features can be represented in ASL. Item features used in GAAP were identified by reviewing commonly used features of released PARCC items, Smarter Balanced items, and items from states (e.g. Minnesota) that have used Technology Enhanced item features in their state tests.

All guidelines contained in this document were developed through a process of triangulating findings from GAAP qualitative and quantitative research, insights from the team-based approach to creating ASL versions of test items, and by expert review. GAAP research findings are summarized in a white paper and research brief. Both documents can be downloaded from the project website: http://gaap.measuredprogress.org/gaap/.

ASL Grammar Guidelines:

1) **Syntax/grammatical structure:** Like all languages, ASL is rule-governed, operating on a specific set of linguistic principles that distinguish it from other languages, including English. ASL and English can express the same content, but employ different rules to do so. When creating ASL versions of test items, every sentence must be signed in a manner that conforms to rules governing ASL word order, sentence type, subject-verb-object agreement, prosody, and classifier constructions.

   a) **Word order:** ASL, like every other language, follows a set of syntactical (word order) rules in the composition of sentences. It is imperative when translating test items to adhere to the rules governing ASL syntax, rather than defaulting to the word order of the sentences as written in the English item. In order to convey the exact meaning of the test item, and prevent confusion, sentences must be composed carefully and thoughtfully, with respect to ASL syntax. For example, the first five words of the English sentence “Jamie goes to the store [to buy magazines]”, is structured differently in ASL: the object is stated first (the store), the subject second, (Jamie), and finally the verb (goes).

   b) **Sentence types:** A variety of sentence types are used in ASL. Decisions about which sentence type to use should be guided by the content in the item, what is being measured, and maintaining students’ interest and engagement. Some example sentence types are provided below.

      i) **Rhetorical questions:** In ASL, sentences can include rhetorical questions. For example, the English sentence “Jamie goes to the store to buy magazines” can be structured in ASL as “STORE, JAMIE GOES-to-it, WHY? to-BUY MAGAZINES.”

      ii) **Conditionals:** Conditional sentences express hypothetical situations and their consequences, or factual implications. In ASL, non-manual grammatical features distinguish the dependent clause containing the conditional “if he buys two magazines” and the main clause conveying the consequence “how much money will he have left?” In addition, a brief pause after the dependent clause marks the transition to the main clause. (See the section on non-manual grammar below for more information.)

      iii) **Topic comment:** Like a number of other languages, including English, ASL sentences may be presented in a topic-comment structure. The topic is declared at the beginning of a sentence, and marked with linguistically correct non-manual grammatical features. The remainder of the sentence relates to the established topic, and is marked as the comment. To convey the same meaning as the English sentence “School is on Monday morning” the signer first introduces the topic, SCHOOL, and then completes the phrase by commenting on the topic, is-on-MONDAY MORNING.

   c) **Prosody:** Prosody in any language plays an important role in the production and perception of every utterance. Prosody provides mechanisms for organizing, sequencing, shifting topics, separating ideas, and providing hierarchy. In spoken languages, prosody manifests as pausing, inflection, and emphasis, expressed by altering the speech stream through stress, lengthening, and
Volume. In ASL, visual prosodic features also include pausing, inflection, and emphasis, and are expressed by altering the sign stream through stress, lengthening and varying use of sign space. It is important when developing ASL videos of test items that prosodic features are used in a linguistically appropriate manner to provide structure and organization, thereby ensuring that students have clear access to the test content.

d) **Classifier constructions:** Classifier construction uses the body, space, and time to represent settings, objects, and events. For example, in the English sentence, "A car went up a hill and parked at the top", the signer would first sign CAR, then use a thumb up three hand-shape (thumb, forefinger and middle finger with thumb pointing up) to represent the car as a classifier, and a specific movement pattern to represent the car going up a hill and parking at the top. Manner and other adverbial information are also efficiently and appropriately conveyed in classifier constructions; e.g., a car moving quickly up a hill is represented differently than a car moving slowly.

e) **Non-manual grammar:** Non-manual grammar in sign languages is most often expressed on the face and conveys a rich array of information such as sentence type, topic marking, and adjectival and adverbial modifications. Grammatical markings include changing facial expressions through the eyes, cheeks, and mouth, and shifting body movements. Non-manual elements are very important components of ASL grammar as they add a layer of obligatory linguistic information "across" the signs being uttered.

i) **Inflectional facial expression/sign movement:** Facial changes such as raised eyebrows, puffed cheeks, pursed lips, clenched teeth can all be used to show size, degree, manner, and temporal aspect (time) of what is being signed. As an example, the word "large" might be shown through a sign, where "huge" is shown using the same sign, with altered hand movement, puffed cheeks, and raised eyebrows.

ii) **Negation/affirmation:** Non-manual markings for negation or affirmation can be layered across a sign, phrase or sentence, by simultaneously signing while also nodding the head "yes" or shaking the head "no." Timing is an important element in negation and affirmation; the correct signal must be applied over the correct string of signs to accurately convey the information desired. For example, to express "not" in the sentence "I will not be going tonight", the signer may add the non-manual marker of the head shaking "no" across the entire sentence. If "I will not be going tonight," is followed by, "but I will be going tomorrow," the initial negation quickly switches to affirmation at the appropriate moment.

2) **Noun/pronoun structures:** In ASL discourse, as in English, a noun must first be stated before it can be referred back to as a pronoun. Pronouns in ASL involve pointing to a referent if it is physically present and visible to the signer. If the referent is not present, it is identified with a sign then designated as a referent in a location close to the signer's body. As an example, in the English sentences "A boy has five cakes. He sold three cakes at the school carnival," the boy would first be introduced with the sign for BOY, and then "assigned" a physical referent space close to the signer. From that point on, BOY would not be signed, rather the physical location that the signer previously established serves as a pronoun [equivalent to saying "he" in English]. Test items that contain proper names, such as "Jason has five boxes" are introduced according to this rule. The signer begins by stating that there is a boy and his name is Jason. After introducing Jason, a physical referent point can be established, which, when pointed to, is the pronoun for Jason. Alternatively, the name can be quickly fingerspelled to reintroduce Jason.

3) **Numbers and Plurality:** More than a dozen numbering systems have been identified in ASL, many more than the two found in English (i.e., cardinal and ordinal number systems). As a result, pluralization of actions and nouns is a complex process in ASL; some nouns and verbs can be inflected for plurality via numeral incorporation or a process known as reduplication and some cannot. When numeral incorporation or reduplication is ungrammatical, plurality must be expressed with additional signs, e.g., the sign for CAT followed by THREE to indicate three cats. Therefore, careful consideration
must be given to presentation of numbers and plurality in test items. Two examples of many are presented here.

a) **Number incorporation:** Number incorporation occurs when a number is included in a sign. For example, in the sign for “three years-old” the sign for AGE and the number THREE are combined to simultaneously include both pieces of information. To do so, the signer starts with the number three hand-shape in ASL (thumb, forefinger and middle finger) touching the chin at the tip of the forefinger. The THREE hand shape then moves away from the chin in a specific sweeping motion, which is the sign for “years old” or “age”, creating one sign that has the equivalent sweeping motion of a two or three word phrase in English.

**Pluralization:** When nouns are pluralized, the linguistically correct movement such as sweeping, inflection of movement, reduplication, and repositioning must be used. For example, “he” changes to “they” by inflecting the single movement in the sign for “he” to a sweeping motion of the dominant hand to indicate there is more than one person.

4) **Verbs:** ASL verbs can be modified to show the type of action, incorporate subject and object information, and can include things like repeated action or action over time.

a) **Appropriate directionality, pronoun and subject/object incorporation rules for ASL verbs:** Those verbs that are indexical, or incorporate information about subjects and objects, are signed in a specified path from subject to object. This movement path is the only way to differentiate such English sentences as “Sally walked home from school,” and “Sally walked to school from home.”

b) **Temporal actions/repeated actions:** In ASL, unlike English, there are no grammatical tense markings on verbs; additional signs are used to mark past, present, or future action. However, there are many ways to modulate ASL verbs for verbal aspect, framing the action with respect to time (frequency or duration) using linguistically patterned signing, movements and beats. These are known as reduplication and aspect (placing the verb in an aspectual frame). Through reduplication, aspectual framing, or a combination of both, signers can show if something is happening regularly, continually, repeatedly or for an extended period of time. This process often differs from one ASL verb to the next. Verbal aspect is a complex linguistic process with somewhat unusual rules in ASL; therefore, careful consideration must be given to ensure appropriate choices are made when preparing ASL test items. In the ASL version of the sentence “Rachel and Joe study together every week” the verb STUDY is inflected with a specific movement pattern and beat to indicate that the studying happens regularly.

**Content Guidelines**
This section describes guidelines for presenting specific types of test content in ASL: mathematical terms; mathematical expressions and equations; concepts of multiple people or objects, or repeated actions; graphs and images. In our discussion of content guidelines we also include a general guideline for setting up items in ASL.

**Mathematical Terms**
Test items in mathematics often include specific mathematical terms that are integral to the construct being measured. Many states’ sign guidelines explicitly assert that some math terms need to be represented in English via fingerspelling because there is a concern that signing these terms may cue students to the correct answer and/or provide extra information. Fingerspelling is the process of presenting each letter of an English word or term individually, instead of presenting the ASL sign for the term. To inform the development of guidelines related to mathematical terms, GAAP researchers reviewed previous research on the use of fingerspelling and, as part of both the GAAP qualitative and quantitative research studies, examined student performance on items using fingerspelling and ASL signs for math terms. GAAP ASL Guidelines for presenting mathematical terms are described next.
When creating ASL versions of test items, it is important to consider construct violation issues and examine the extent to which a math sign provides comparable, more, or less information than the English word in print. When item development teams engage in discussions about construct violation, it is important for team members to critically evaluate the meaning conveyed by both the individual ASL term(s) and the individual English term(s), as well as the meaning of the entire item conveyed in each language. For example, consider the term “triangle.” The ASL term TRIANGLE is signed as a shape with three sides. If a test item is designed to assess whether or not students can identify a triangle from among a group of shapes, or describe the properties of a triangle, one might argue that the sign for triangle cues students to the correct answer because of its physical representation of a three sided figure. However, one might also argue that the word “triangle” when printed in English provides two key cues to students that could give them an advantage in answering the test item 1) “tri” could signal to the student that there are three of something and 2) “angle” tells the student that the shape includes angles. Looking at the meaning conveyed from these two perspectives, it is clear that the ASL sign and English word for triangle provide potential cues to the meaning of the word. This example illustrates the importance of critically examining both the ASL and English text for the term in question and examining each from multiple perspectives. Words in ASL and English (like words in all languages) provide meaning; sometimes the two languages provide different cues, but even then often of a similar type. It is important to use each language to convey the test content without focusing on direct or word-to-word translation.

Consider the additional cognitive complexity that is added to the test item when a term or terms are fingerspelled rather than signed. Choosing to fingerspell terms over using ASL signs may add to the cognitive complexity of the test item because it requires students to decode and comprehend the English spelling of the term. Fingerspelling a word that has an ASL sign to a deaf student during an assessment is comparable to requiring a hearing student to listen to a word spelled aloud rather than allowing him/her to read the word in print. In both cases, the cognitive complexity is increased because the student has to first recognize a word that is being conveyed in an uncommon format before he/she can consider the meaning of the word. Research shows that fingerspelling may increase the cognitive complexity of receiving information through sign language (Hamilton, 2011; Krakow & Hanson, 1985; Rudner, Karlsson, Gunnarson, and Rönnberg, 2013). This increase in cognitive load could make it more difficult for the students to understand and respond to the item. There may also be issues related to cumulative fatigue when a high quantity of terms are fingerspelled across the assessment. In addition, it is important that fingerspelling used in assessment is consistent with the way fingerspelling is used during instruction.

Limit fingerspelling to cases where most students are unlikely to be familiar with an ASL term and where fingerspelling a term would be linguistically appropriate. When there is an ASL term available, it should be signed, followed by the fingerspelled English equivalent. GAAP research shows that students prefer key terms be presented using either only the ASL term, or the ASL term followed by a fingerspelled English equivalent, over the fingerspelled English term alone. The GAAP team recommends limiting fingerspelling to cases where most students are (a) unlikely to be familiar with a sign and (b) where fingerspelling a term would be linguistically appropriate. Some examples include “quadrilateral”, “estimates”, and “function”. When fingerspelling is used, the ASL term should be presented first, followed by the fingerspelled English term.

Mathematical Expressions and Equations
Mathematical expressions and equations are a form of notation often incorporated into test items (e.g., \(X + Y = 45\)). Including mathematical expressions and equations in ASL assessment items could present two challenges to students’ understanding of the content in the item. First, when items contain long or complex expressions and equations, the number of signs in the item increases greatly; this may add construct-irrelevant cognitive complexity to the information that a student needs to process while viewing the ASL version of the item. The second issue is that there can be more than one way to sign expressions and equations and if the method used in the ASL version of the item is not consistent with instruction, the student may be confused, resulting in
compromised access to the test content. For these two reasons, GAAP researchers studied the impact of signing expressions and equations versus not signing expressions and equations in test items. The GAAP ASL Guideline for presenting mathematical expressions and equations is described next.

- **Sign mathematical expressions and equations in ASL versions of test items.** We did not find a statistically significant difference in student performance on ASL items with expressions and equations included, and items presented without expressions and equations (in these cases, the ASL item was structured to refer test-takers to the numerical information in the English text item). Overall students expressed a preference for having expressions and equations included in the ASL item. Therefore, the GAAP team recommends signing mathematical expressions and equations in ASL test items and embedding video clips of expressions and equations into items in such a way that viewing them is optional for the students, particularly when they appear in the answer options.

**Concepts of Multiple People or Objects, or Repeated Actions**
As discussed in the ASL Grammar section above, ASL employs linguistically patterned movements to represent plurality, for example, multiple people, objects, or actions. GAAP researchers studied whether test items containing actions occurring more than once should include reduplication -- where the signer depicts the action done more than once. This is in contrast to signing the verb in citation form and then indicating the number of times the action occurred with additional words. The GAAP ASL Guideline for presenting multiple people or objects, or repeated actions is described next.

- **When developing ASL versions of test items with multiple people or objects, or repeated actions, use the strategy that is most linguistically appropriate. In most cases, this will be the reduplication strategy.** We did not find a statistically significant difference in student performance on items that used the reduplication strategy and those that did not. When asked about their preference, an equal number of students preferred the reduplication strategy over the non-reduplication strategy. Thus, the GAAP team recommends using the strategy that is most linguistically appropriate to the item, which the GAAP sign team most often found to be employing the reduplication strategy.

**Graphs and Images**
When presenting test items in a visual-spatial language such as ASL it is important to consider how to pronominalize by establishing and referring to information in the space around the signer. In ASL, both abstract and concrete information can be presented spatially in a number of ways. GAAP researchers studied two issues related to graphs and images. GAAP researchers examined whether students need ASL descriptions of graphs or images shown in an item or whether it is sufficient to sign only the text associated with the graphs or images shown in an item. The GAAP research team also studied whether graphs are best presented and referred to on the signer’s non-dominant hand or in general space in front of the signer’s body. In either case, graphs and images are presented as viewed from the signer’s perspective, not from the viewer’s perspective, consistent with the rules of ASL. The GAAP ASL Guidelines for describing graphs and images are described next.

- **Provide brief ASL descriptions of graphics and images.** GAAP research shows that students prefer items that include brief descriptions of graphics and images over items where no description was provided.

- **When describing graphs, the characteristics of the graph in the ASL version should be consistent with the text-based version of the graph.** For example, if a line graph is being referred to, the signer should orient the graph from his/her own perspective on the horizontal or vertical plane and depict the line in the same direction and slope as the graph on the computer screen.

- **Graphs should be presented in the most linguistically appropriate way. In most cases this will be in general space in front of the signer’s body.** We did not find a statistically significant difference in student performance on items where a graph was presented on the signer’s non-dominant (less active) hand and items where the graph was presented in general space. Equal numbers of students preferred the non-dominant hand strategy and the general space strategy. The GAAP team recommends using the strategy that is most linguistically appropriate and easily seen on video, which the GAAP ASL team found to most often be employing the general space strategy.
**Item Set Up**

Many test items present several sentences or a table of information before asking the student to respond to a question. GAAP researchers hypothesized that using a strategy often employed in ASL discourse known as “diamond structure” to set up items might help students focus their attention and engage appropriately with the content. Items set up using the diamond format introduced the question or goal first and restated it at the end, with item information inserted between. The rationale for this hypothesis was that much of ASL syntax and structure establishes the reference point, topic, or goal of the discourse first, and then follows with associated relationships or actions. It also clarifies the goal of the test item first, perhaps creating a context for the remaining components of the item and thus lowering cognitive load. GAAP researchers compared student performance on items using the diamond structure and items set up in the traditional format of information followed by the question. The GAAP ASL Guideline for item set up is described next.

- **Information-heavy items should be presented in diamond format.** While no statistically significant differences in student performance were found between items using the diamond set up and non-diamond format items, students expressed a preference for the diamond format. As a result, GAAP researchers recommend that information heavy items be presented in diamond format and note that the diamond format is similar to a test-taking strategy that students are often taught which is to read the question first.

**Considerations for Technology Enhanced Item Features**

Advancements in computer-based testing technology and the emergence of college and career readiness standards have both contributed to the rise of new and innovative assessment item types (Almond, et al., 2010; “States Leading Sea Change,” 2012; Winter, Burkhardt, Freidhoff, Stimson, & Leslie, 2013). These new, technology-enhanced (TE) items are being implemented with the hopes of increasing student engagement and producing better measurement of students’ knowledge and skills. Because TE items require students to respond differently than traditional paper-and-pencil item types, the GAAP team considered how to best represent some of the features of TE items in ASL. Often accurate portrayal in the ASL versions of such items entailed careful consideration of the specific task incorporated into the test item, due to the fact that ASL’s visual-spatial properties differ substantially from the linear properties of printed English. While TE item features were not the focus of GAAP research, TE items were employed in both the cognitive labs and randomized controlled trial and the GAAP team discussed strategies to represent the item features in ASL. This section summarizes some common features of TE items and offers guidance, based on team input and consensus, on how these features can be represented in ASL.

**Multiple Response Item Formats**

Some TE items ask students to choose *one or more* correct answers from a list of possible answer choices. These items are often referred to as multiple answer, select all that apply, or multiple select formats. For example, one item used in GAAP research asked students to “select all equations that are true from a list of five equations.” One of the challenges in presenting this information only once (as written), is that students taking the ASL version must play back the item to locate and review instructions as possible answers are considered, while students taking the English print version may more easily locate the relevant text to remember what is being asked of them. Therefore, the GAAP team considered the option of embedding instructions into the item response format. The decision here was about how to set up the item response structure, not about how to present the content of the responses. The GAAP ASL team decided that instead of presenting a prompt such as, “Click on all of the equations that are true” only a single time, followed by the equations without any other information, the prompt should be presented at the beginning and then, after signing each equation, restated: e.g., “Is this true? If yes, click.” This approach parallels the expected process of test takers considering the truth or falsity of one answer choice at a time. The GAAP team recommends this approach on similar item formats with brief prompts to avoid any confusion that the student might have in what is expected of him/her to answer the item. In cases when the prompt is not brief, present the prompt only once, before the answer options, to avoid excessively lengthy and cumbersome test items.
Drag and Drop
The “drag and drop” TE item feature requires students to move “draggers” or objects to a “drop zone” or area within the test item. As an example, one item used for GAAP research required students to decide which numbers (the draggers) to move into boxes within an equation (drop zone) to make the equation true. In this case, the item was structured to first introduced the drop zone and briefly explain the task (to move the numbers to the equation), then ask the student to complete the task of using numbers to complete the equation, while depicting the action of dragging numbers to the drop zone. As with the graphs and images, this action is presented from the signer’s perspective, not from the viewer’s perspective, consistent with the rules of ASL. While the order of information presented will depend on the item set-up, it is important to use proper visual orientation (up and down, left to right, etc.) based on where the draggers and drop zone are physically located relative to one another on the test item and to accurately depict the motion of dragging and dropping objects with respect to the item.

Hot Spot
Some TE items, generally referred to as “hot spot,” require that a student click on a section of the item’s physical space (sentence, phrase, shape, bar on a graph) to respond to the item. One item used in GAAP research required students to click above labels on the horizontal axis of a graph to create bars on a bar chart. In this case, the item information was introduced, followed by a brief explanation of the task of creating a bar graph, ending with the statement that clicking on the bar graph would result in a bar filling in the space between the spot clicked on and the horizontal axis. While different hot spot items will require different tasks, the GAAP team recommends incorporating statements that both indicate to the student what action is needed to produce a response and then the result of that action.

Section Five: ASL Filming Considerations for Assessment Content
In addition to using video production specialists with prior experience developing ASL videos, using high quality equipment to produce clear videos is also important. The GAAP ASL Team recommends the following specifications and equipment:

- Shoot videos at 720 or 1080 high definition.
- Use a teleprompter that allows for a “flip” from the computer screen to the monitor so that the signer, interpreter, and assessment/accessibility specialist can view the test item being signed and allows the team to edit the item with notes as needed.
- Use high quality lighting with a background that contrasts with the signer’s skin tone.
- The signer must wear a similarly contrasting long sleeve shirt of a slightly darker or lighter shade so it doesn’t blend in with the background. The signers clothing and jewelry must not be distracting.
- The signer must hold his/her hand in front of this backdrop or shirt and facing the camera when fingerspelling or signing numbers to ensure color contrast and visibility of all five fingers.
- The signer presents all content directly into the camera, to orient eye gaze correctly toward the video’s “audience” and show the signer’s full face, torso, and both hands clearly. Pacing should be consistent with instruction.
- Shoot videos from the waist up with enough room to the side and above the signer’s body to allow for item set up in space while maintaining a tight shot that all of the signer’s non-manual grammar can be seen clearly.
- Include audio recording of the interpreter stating what was being signed and when during item production to ensure that the correct video is associated with each item.
Appendix A: GAAP ASL Working Group Team Member Biographical Sketches

Trinell Bowman chairs the Partnership for Assessment of Readiness for College and Careers (PARCC) working group on Accessibility, Accommodation and Fairness and has seven years of program management experience with the Maryland State Department of Education's Division of Curriculum, Assessment and Accountability managing Maryland assessments for students with disabilities and accessibility and accommodation policies. In addition, she has represented Maryland on various federal Enhanced Assessment Grants focused on how online delivery systems can deliver accessibility and accommodations in a digital environment. Before transitioning to a state level role, Trinell worked for ten years in the educational field as a social worker, special education teacher, assistant principal, and principal. Trinell’s state and consortia perspective on accessibility and accommodation policies and procedures was critical in guiding the GAAP ASL Team’s focus.

Christopher Kurz is an associate professor for the Masters of Science in Secondary Education program at Rochester Institute of Technology, and co-director of the Research Center for Teaching and Learning at the National Technical Institute for the Deaf at Rochester Institute of Technology (NTID@RIT). He has taught mathematics and science to high school and college deaf students for over fifteen years. He earned his bachelor’s degree in Applied Mathematics, his master’s in deaf education, and his doctorate degree from the University of Kansas in Foundations of Education. He has made numerous presentations, conducted workshops and developed educational media materials for K-12 teachers of the deaf and educational interpreters. Currently, he maintains a clearinghouse website on mathematics for the deaf. For the past two years, Chris worked with a team led by the Massachusetts Department of Education to create an ASL DVD of the 10th grade MCAS mathematics test.

Lori Moers is Assistant Principal at the Maryland School for the Deaf, Frederick and has been in the field of education for 30 years. She holds BA in English and M.S. in Education. She has taught High School English, Early Childhood Education and Elementary. In addition to this, she has also worked as an elementary school reading specialist and was a co-coordinator for CAEBER National ASL/English Bilingual Early Childhood Education. Lori’s area of expertise is in language arts.

Jeanne Reis earned her master’s degree in Education of the Deaf and a bachelor’s in linguistics. An interpreter in private practice and an interpreter educator, Jeanne also manages the ASL STEM Project at Boston University. For over 25 years, she has been working in K – 12 and post-secondary settings. Jeanne regularly provides training to education professionals and consults with the Department of Education and other organizations on K – 12 interpreting and delivery of academic content in ASL. She established the EIMP, the first mentorship program for educational interpreters in Massachusetts, and has developed and presented the ASL STEM Educational Interpreter Institutes with support from the Mass Department of Elementary and Secondary Education since 2005. Working with a team of experts, Jeanne collaborates on creating ASL versions of state standardized tests.

Stephanie Cawthon is an Associate Professor of Educational Psychology at The University of Texas at Austin. She received her Bachelor’s and Master’s degrees in Psychology from Stanford University and her doctorate in Educational Psychology from the University of Wisconsin-Madison. Dr. Cawthon’s research focuses on accessible assessments for students from diverse linguistic and cultural backgrounds, with a specific expertise related to students who are deaf or hard of hearing. Her previous projects include investigation of the differential effects of accountability reforms for students at schools for the deaf, the effects of ASL as a test accommodation on test scores, and how elements of test items such as linguistic complexity and the inclusion of graphics interact with student characteristics such as content area proficiency and literacy skills.
**Mark Johnson** is an Assistant Director of Content, Design, and Development at Measured Progress. He began his career in education by teaching mathematics at the middle school and high school levels for 17 years. Early in his career, Mark recognized the importance of assessment in education and became a leader in the Vermont Portfolio Project in 1990 and followed with involvement as a teacher consultant in a variety of national and state assessment projects. He embarked on a full-time career in assessment in 2003, joining the Office of Student Assessment at the Massachusetts Department of Elementary and Secondary Education, where he served in a variety of roles, including as Acting Director of Student Assessment. In his tenure at the Department, Mark was instrumental in launching the creation of ASL DVD versions of the grade 10 MCAS Mathematics test. He joined Measured Progress in December 2011, bringing his vast experience in educational assessment to key roles within the organization, where he has remained involved in accessibility and accommodation work.

**Lisa Famularo**, Director of the Measured Progress Innovation Lab, oversees all research and development activities conducted in the Lab. She holds a Ph.D. in Educational Research, Measurement and Evaluation from Boston College. Dr. Famularo has over 18 years of research experience and has served as Project Director/Principal Investigator on both large and small research projects funded by federal, state and local government agencies, non-profit organizations and academic institutions. Her recent work in the area of assessment research has included a project on accessibility tools for students who have visual impairments and a review of literature on alternate assessment. Dr. Famularo has also managed projects and co-authored several documents related to item development and assessment accessibility for the Smarter Balanced Consortia. Dr. Famularo is dedicated to authoring publications that translate research findings for multiple and varied audiences, most notably policy makers and education leaders. Most of her publications focus on bridging the gap between academic research, policy, and practice.

**Rachel Hall** is a research assistant at the Measured Progress Innovation Lab. She has a background in school psychology and has three years of experience supporting research projects pertaining to assessment accommodations with the Lab. As part of the GAAP project, Rachel gathered and reviewed relevant literature as well as released items from states and consortia, and managed the process of inserting test items and ASL videos within the computer-based testing system used for all GAAP research. Rachel also managed recruitment of GAAP study participants and acted as the primary interface between participating teachers and students and the research team.

**Jennifer Higgins** is a Research Scientist at Measured Progress’s Innovation Lab and has 12 years of experience managing research on assessment accessibility. Work that Jen was involved in at Boston College’s Educational Research Measurement and Evaluation department led to the development of technology that allowed teachers to select digitally embedded accessibility and accommodation tools for students prior to testing, creating a personalized testing experience for students. One of the accessibility tools developed and piloted in 2009 was ASL video support. Over the past six years Jen has managed four multi-million dollar federally funded Enhanced Assessment Grants, working with 18 states and multiple partners to conduct research and development in an effort to improve the accessibility of digitally delivered assessments. This work has resulted in multiple scholarly articles and educational research conference presentations.
References


Endnotes

i For a history of ASL, a summary of early work, and the study of its use see Stokoe (1960, reprinted in 2005). For a more contemporary view on the history of sign language see Shaw & Delaporte (2010).

ii Estimates of how many individuals use ASL are highly dependent on the data sources and data sampling strategy. For more discussion of ASL usage estimates see Mitchell, Young, Bachleda, & Karchmer (2006).

iii Estimates of the number of students who are DHH and who use ASL are typically drawn from the Gallaudet Annual Survey. See Mitchell (2004).


v There are multiple factors involved in language development for children who are DHH. For example, see Bailes (2001); Easterbrooks (2005); Hyde et al. (2010); Lieberman, et al. (2013); Luckner et al (2005/2006), for nuanced discussions about parent decision making, language development, literacy development, and socio-cultural factors that influence this process for students who are DHH.

vi The extent to which written English tests are a potential barrier for individuals who use ASL depends on multiple factors, including the format and linguistic complexity of the test item, the quality of accommodation, the language of instruction, and opportunity to learn test content. See Cawthon (2011) and Cawthon et al., (2011) for further discussion.


viii Estimates are that less than 5% of children who are deaf or hard of hearing have at least one parent who is also deaf or hard of hearing. See Mitchell & Karchmer (2004) for a discussion of how available data impacts strength of these estimates.

ix See early work in this area by Braden (1994) and Meadow (1980).

x For a discussion of emergent literacy for very young children see Williams (2004). For a summary of academic performance on standardized tests of mathematics and reading see Qi and Mitchell (2012). For a discussion of the relationship between academic English literacy and long-term education and employment outcomes, see Garberoglio et al. (2014).

xi Locally administered assessments with an interpreter were commonly used prior to video-capacity and online delivery of assessment (Cawthon & the Online Research Lab, 2006).

xii Interpreters fall under the broader category of access assistants. This issue is explored further in Schick, Williams, & Kupermintz (2006).

xiii For related work on online delivery of assessments see the work of Kopriva and Carr at: http://iaassessment.wceruw.org/.

xiv There are many elements to test item development that can impact the extent to which test item translations lead to valid measurement of student knowledge and skill. For discussion related to students who are English Language Learners, see Abedi et al. (2005) and Abedi & Gandara (2006).

xv Note: Information about utterances in a signed language is difficult to convey using the written form of a spoken language, as the multiple layers of linguistic information that can be expressed simultaneously in a visual-spatial language are not easily captured or represented in linear print form. In this document, we have attempted to provide written examples of the ASL features discussed using a specific glossing convention. All information being conveyed via ASL is glossed using a combination of ASL signs, which are in capital letters (e.g. BUY), and English conventions in lower case letters, to indicate English markings for case, temporal, tense, etc., that don't exist in ASL (e.g., SHE BuYS). Where one sign represents two or more English words, the string of words is hyphenated, with ASL-only words in capital letters and English-only words in lower case, as in to-BUY.
It is important to note the role of instruction in these decisions. Students who are receiving appropriate, aligned, grade-level instruction will have appropriate familiarity with mathematical terms, whether their language of instruction is English or ASL, and those who are not receiving such instruction may not.