MASTER TEACHERS’ RESPONSES TO TWENTY LITERACY AND SCIENCE/MATHEMATICS PRACTICES IN DEAF EDUCATION

UNDER A GRANT to improve outcomes for students who are deaf or hard of hearing awarded to the Association of College Educators—Deaf/Hard of Hearing, a team identified content that all teachers of students who are deaf and hard of hearing must understand and be able to teach. Also identified were 20 practices associated with content standards (10 each, literacy and science/mathematics). Thirty-seven master teachers identified by grant agents rated the practices on a Likert-type scale indicating the maximum benefit of each practice and maximum likelihood that they would use the practice, yielding a likelihood-impact analysis. The teachers showed strong agreement on the benefits and likelihood of use of the rated practices. Concerns about implementation of many of the practices related to time constraints and mixed-ability classrooms were themes of the reviews. Actions for teacher preparation programs were recommended.

Recent mandates at the federal level such as those in the Individuals With Disabilities Education Act and the No Child Left Behind Act require the field of deaf education to pay increased attention to curriculum content standards and accountability. In fall 2003, the Association of College Educators of the Deaf and Hard of Hearing (ACE-DHH) received a federal grant (Join Together, P342A030098) to improve practices for students who are deaf or hard of hearing. This grant was divided into eight sections, one of which was Section 2.2, Content Best Practices. A team was organized to investigate this topic. The objectives of the team were (a) to identify the content to be taught and methods for teaching that content and (b) to propose enhancements to teacher preparation based on data and field evidence. These two objectives were addressed across two broad categories: literacy and science/mathematics. Literacy, science, and math became the focus because they are routinely identified as areas of critical need throughout education (Office of Postsecondary Education, 2006). In the present article, we present the findings of Team 2.2. We present a discussion of content standards, define research-based practices, provide a summary of the literature, and offer data from master teachers of students who are deaf or hard of hear-
Definitions
To facilitate ease of reading, we begin by providing definitions of several concepts. By deaf or hard of hearing or deaf and hard of hearing we mean that segment of the student population served by teachers trained in any of the teacher preparation programs that identify themselves as programs in deaf education and that lead to state certification.

Definitions of Standards-Related Terms
By standards or standard curriculum we mean that set of curricular objectives that a particular state or specialized professional association identifies as being the common core that all students should be able to understand or perform (National Council for Accreditation of Teacher Education, 2006). Entity standards are common standards, and therefore often represent typical or average expectations of all individuals. Used in this context, the term standard implies a common expectation rather than a loftier goal. By the term content best practices we refer to those practices that have been proven effective for teaching the various aspects of a curriculum that have been deemed critical for all students to learn.

Definitions of Research-Based Practices
Research-based practices have become an important topic of discussion in education, as the vast array of education interventions has limited evidentiary backing (National Center for Education Evaluation and Regional Assistance, 2003). At the inception of the investigation for the present study, little guidance was available regarding parameters of research quality. Easterbrooks (2002) used the procedures established by the Washington State Institute for Public Policy in a review of the literature for the institute. Standards for research veracity were ranked on a 5-point Likert-type scale using the institute’s definitions (Aos, Phipps, Barnoski, & Lieb, 2001). A modified version of this scale, described later in the present article under “Task 2: Review of the Literature on Best Practices in Deaf Education in Literacy, Science, and Mathematics,” was applied to the literature review in the article.

Luckner, Sebald, Cooney, Young, and Muir (2005) reported the results of a review of 40 years of literature on literacy and deafness, applying a stringent definition of “scientifically based research” (National Center for Education Evaluation and Regional Assistance, 2003), as well as criteria from the What Works Clearinghouse (Valentine & Cooper, 2004). Despite an exhaustive review of the literature, Luckner and colleagues were able to locate only 22 studies that met their inclusion criteria. They concluded that “(1) no two studies examined the same dimension of literacy (e.g., reading comprehension, vocabulary, word recognition, writing),” and “(2) no replications of previously conducted studies were undertaken” (p. 447). Easterbrooks and Stephenson (in press) conducted a similar review of 10 specific areas of literacy and found similar results.

Taken together, these recent contributions to a definition of research-based practices lead to a new emphasis on quality research. For too long, educators have based decisions on field-promoted practices. But with guidance from the sources we have cited in the present article and standards endorsed by the Council for Exceptional Children (Odom et al., 2005), a new charge to the field has emerged. Educators must assure the public that they are using practices and interventions that are backed by “strong” or “possible” evidence of effectiveness. “Strong evidence” is defined as randomized controlled trials showing effectiveness in two or more typical school settings and including a setting similar to the one in which the intervention is being implemented. “Possible evidence” is defined as randomized controlled trials or comparison group studies showing pre- and post-evidence, evidence from mismatched comparison groups, or meta-analyses (National Center for Education Evaluation and Regional Assistance, 2003).

Project Description
To establish a sense of the knowledge base in the instruction of students who are deaf or hard of hearing, Team 2.2 engaged in a three-part process. First, a review of states’ approaches to curriculum standards and the instruction of students who are deaf or hard of hearing was conducted. The purpose of this task was to determine if any states provided specific guidance to teachers who serve students who are deaf or hard of hearing regarding curricular or instructional practices appropriate for the population. Second, a review of best-practices Web sites along with an extensive review of the literature was conducted to determine the existence of evidence-based and field-promoted practices. Finally, a list of practices was generated from these two sources and a survey conducted with master teachers of students who are deaf or hard of hearing to determine a rating of the perceived benefit relative to the likelihood of use of the practices identified within the knowledge base.

Task 1: Review of States’ Standards and Professional Web Sites
A review of states’ standards was conducted to investigate content per se,
not necessarily best practices for instructing students in that content. During the first year of the Join Together grant, team members were identified from the ACE-DHH membership and assigned to investigate information from states in regions that corresponded to those identified by the Regional Resource and Federal Centers network. The six regional resource centers are specifically funded to assist state education agencies in the systemic improvement of education programs, practices, and policies that affect children and youth with disabilities. The tasks assigned to each team member were (a) to provide a summary of the standards in the assigned states and (b) to conduct telephone interviews with state program directors, project assistants, education associates, service directors, state specialists, or other individuals responsible for providing state-level direction to school systems serving the deaf and hard of hearing school-aged population. Data were gathered from 33 states’ Web sites and from specialists in the same 33 states. Most of the states had highly specified core curricula. With one exception, all of the states required all of their teachers of students who are deaf or hard of hearing to teach from the general curriculum.

Whitesell and Easterbrooks (2005) reviewed the data that was gathered and found a commonality of structure among the standards. Most were organized into strands or categories and by grade level or grade range. Table 1 lists topics and concepts that appeared in virtually all of the states’ curriculum documents. Topics that did not appear repeatedly (e.g., science safety and vertex-edge graphs) were not included. This is not an exhaustive list of curriculum objectives or standards but represents minimum commonality among standards, and is intended to present content with which all future teachers of the deaf must be familiar.

Guidance to Teachers of the Deaf From the States

No states reported giving teachers of students who are deaf or hard of hearing specific guidance on how to make appropriate modifications to the general education curriculum. Although most of the individuals who were interviewed spoke of concepts such as differentiating instruction, modifying as needed, or individualizing as recognized and required, only one state actually provided specific suggested adaptations or modifications to its general curriculum guidelines. There appeared to be three different approaches taken to the general curriculum:

1. The “one size fits all” version, in which no modifications in objectives are allowed. Comments included “There are no alternatives. All children will achieve.”
2. The “mix and match” version, in which objectives are chosen at different grade levels. Comments included “Teachers may use the standards appropriate for a child’s current level of functioning in each subject area.”
3. The “rungs of the ladder” version, in which teachers are required to show a connection between individualized education program (IEP) objectives and curriculum standards and are then permitted to teach from the objectives in the IEP.

No state gave specific guidance on how to decide when a student should be taking the regular curriculum or a special curriculum. Almost all interviewees stated that, as one put it, “it is determined by the IEP team.”

After a review of the states’ structures of curriculum in literacy, science, and math, there appeared to be a lack of clarity as to the difference between a standard, a set of curriculum entries, and a curriculum. These words were often used interchangeably on the Web sites and in the interviews. Whitesell and Easterbrooks (2005) provide a complete examination of the review of the states. Currently, the pervasive expectation is that students with hearing loss will be placed in the regular curriculum. All interviewees indicated that their states required teachers of students who are deaf or hard of hearing to differentiate materials, instructional strategies, and methods, but none indicated how to accomplish this.

Recommendations to Teacher Preparation Programs

Whitesell and Easterbrooks (2005) recommend that teacher preparation programs in deaf education make sure that teachers in training

- have had experience navigating their state’s curriculum Web site
- understand the basic set of literacy, math, and science concepts required by the states, as well as how to teach these concepts
- have experience identifying general education curriculum objectives and relating these to IEP objectives for the purpose of identifying how to bridge the gap between what is expected of students and their present levels of functioning

Task 2: Review of the Literature on Best Practices in Deaf Education in Literacy, Science, and Mathematics

After an exhaustive review of the states’ Web sites and the Web sites of various specialized professional associations and other professional organizations,
Table 1
Content Standards Identified by the Reviewed States

<table>
<thead>
<tr>
<th>Content area</th>
<th>Skill / topic</th>
<th>Curricular area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Solve problems</td>
<td>-Understand and use math terminology, processes, and operations</td>
</tr>
<tr>
<td></td>
<td>Reason mathematically</td>
<td>-Make real-world mathematical connections and applications</td>
</tr>
<tr>
<td>Topics</td>
<td>Number sense and computation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measurement and estimation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ratios, proportions, and percents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Algebra</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spatial sense and geometry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Statistics, data analysis, and probability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patterns, functions, and relationships</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discrete mathematics</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>Scientific process and inquiry</td>
<td>-Critical thinking and problem solving</td>
</tr>
<tr>
<td></td>
<td>Scientific classification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communicating and reasoning scientifically</td>
<td></td>
</tr>
<tr>
<td>Topics</td>
<td>History and principles of science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Natural sciences: Matter—Its properties, structures, and functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy and its effects on matter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Earth and space</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Earth's dynamic systems; ecology; diversity, and continuity of living things</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life science; cycles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry and physics</td>
<td></td>
</tr>
<tr>
<td>Literacy</td>
<td>Understanding and using oral and written</td>
<td>-Research reading and writing</td>
</tr>
<tr>
<td></td>
<td>English (listening, speaking, reading, writing)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skill application</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluation, analysis, and reasoning of and through text</td>
<td></td>
</tr>
<tr>
<td>Topics (and specific skills)</td>
<td>Genres (e.g., mysteries, science fiction, poetry) and types of written materials (e.g., texts, manuals, newspapers, forms, visuals)</td>
<td></td>
</tr>
</tbody>
</table>
Responses to Twenty Literacy and Science/Mathematics Practices in Deaf Education

Task 3: Master Teacher Review of Research-Based Practices
In order to add evidence to the knowledge base regarding the efficacy of the literacy, science, and math practices identified by the team, master teachers from the Join Together grant project were queried regarding their perspectives on the practices.

Method
A 20-item survey consisting of the 10 literacy and 10 science/math practices was designed by the Team 2.2 leaders and sent to various Join Together project members for review. After revisions, it was placed in a Perseus Survey Solutions (Perseus Development Corporation, 2002) online survey tool. We evaluated the results of the survey using likelihood-impact analysis, which is defined as a “technique for reaching group consensus on goals, objectives, strategies, or barriers” (McLaughlin & Olsen, 1988). This type of analysis is used to arrive at group ratings of statements of action to determine the likelihood that the strategy will be used, and then, assuming that it is successful, the impact that might result from taking action (Yates et al., 1979). This approach is used to examine strategies when the task is to select from a set of alternatives. It is an appropriate tool to use in analyzing the reported data because the statements reviewed were instructional strategies. For purposes of the present study, impact was defined as benefit to the student in terms of academic outcomes.

Participants
The questionnaire was e-mailed to all 74 of the master teachers identified by the Join Together grant. Master teachers are “current pre-K–12 teachers who are established (i.e., not in their first years of teaching) and considered particularly innovative and effective in their instruction of students who are deaf/hard of hearing” (Deaf Education Master Teacher Project, 2006). The 74 master teachers came from 25 different states across the United States and represented a cross-section of the country.

Thirty-seven (50.0%) of the master teachers completed and returned the survey. Of these 37, there were 6 (16.2%) who reported that they were deaf, 2 (5.4%) who indicated that they were hard of hearing, and 29 (78.4%) who reported no hearing loss. One (2.7%) self-identified as being Black/African American, 2 (5.4%) self-identified as being of mixed race or ethnicity, and 34 (91.9%) self-identified as being White/non-Hispanic Latino. Twenty-five (67.6%) were classroom teachers of children who are deaf or hard of hearing; 6 (16.2%) were resource/itinerant teachers. Five (13.5%) identified themselves as “other”; these included a speech-language pathologist, a reading specialist, and three regular classroom teachers, all of whom were serving students who were deaf or heard of hearing. The preferred philosophies of communication reportedly used by the master teachers’ programs were speech (3, or 8.2%), sign (9, or 24.3%), speech and sign (15, or 40.5%), Cued Speech (1, or 2.7%), and other (8, or 21.6%). Descriptors applied to “other” included “all,” “bilingual,” and “a variety.” The master teachers ranged in experience from 5 to 29 years.

Results and Discussion: Literacy Practices
In this section, we present the results along with a discussion of each practice.

When asked to rate the literacy prac-
Table 3
Twenty Examined Practices in Deaf Education Ranked by Number of Master Teachers Indicating Benefit and Likelihood of Use

<table>
<thead>
<tr>
<th>Area</th>
<th>Practice Number</th>
<th>Description</th>
<th>Ranking, by clearly to most beneficial</th>
<th>Ranking, by very likely to highly likely to use or do</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy</td>
<td>1</td>
<td>Provide and monitor level-appropriate reading materials for independent reading activities as well as time to read.</td>
<td>2 (86% participant agreement)</td>
<td>2 (83% participant agreement)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Use technology such as CDs, captioned materials, and interest-based Internet sites that are known to be motivating.</td>
<td>4 (76%)</td>
<td>4 (70%)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Teach phonemic awareness and phonics either through structured, auditorially based programs with appropriate modifications for oral students or through specialized materials and techniques that provide visual support to students who sign or need additional visual support.</td>
<td>7 (46%)</td>
<td>7 (45%)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Teach metacognitive skills such as reading strategies (e.g., re-reading, looking at pictures, predicting, visualizing) prior to, during, and after reading through guided reading activities to promote text comprehension.</td>
<td>1 (89%)</td>
<td>1 (89%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Promote reading skill development through written language applications such as dialogue journals, research reading and writing, language experience stories, writing to read, or other language-based programs.</td>
<td>1 (89%)</td>
<td>3 (78%)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Use content-area reading materials to promote reading comprehension through scaffolding and other content-area techniques.</td>
<td>3 (78%)</td>
<td>2 (83%)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Have students collaborate with others on activities that promote literacy development through such activities as shared reading and writing.</td>
<td>6 (62%)</td>
<td>6 (52%)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Teach vocabulary meaning through semantically based activities that enhance knowledge of multiple meanings of words, idiomatic expressions, and denotative (concrete) and connotative (abstract) meanings of words.</td>
<td>1 (89%)</td>
<td>1 (89%)</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Teach vocabulary meaning through morphographemically based activities that enhance knowledge of word meaning through understanding of root/base words, prefixes, and suffixes, including Latin and Greek derivatives.</td>
<td>5 (65%)</td>
<td>5 (64%)</td>
</tr>
<tr>
<td>Science and math</td>
<td>10</td>
<td>Incorporate specific activities and strategies to promote either spoken reading fluency in oral students or signed reading fluency in signing students.</td>
<td>4 (76%)</td>
<td>5 (64%)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Be a skilled communicator in American Sign Language, spoken language, English-based sign systems, or other languages and modes used by students.</td>
<td>1 (92% participant agreement)</td>
<td>2 (92% participant agreement)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Provide science and math concepts using the student's first language before competence is assessed in English.</td>
<td>5 (78%)</td>
<td>3 (80%)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Possess specific training, experience, and certification in content-area knowledge of the subject being taught.</td>
<td>6 (54%)</td>
<td>6 (60%)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Enhance concept mastery through the use of minds-on activities and materials that focus on active-learning principles that cognitively engage students.</td>
<td>3 (84%)</td>
<td>3 (80%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Enhance concept mastery through the use of visual organizers such as graphs, charts, and visual maps.</td>
<td>1 (92%)</td>
<td>1 (97%)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Teach science concepts by incorporating a collaborative, case-based, problem-solving approach to real-world problems, allowing sufficient discussion time.</td>
<td>5 (78%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Use technology such as CDs, captioned materials, and interest-based Internet sites that are known to be motivating.</td>
<td>2 (86%)</td>
<td>4 (74%)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Teach science and math using &quot;specialized content vocabulary&quot; either by signs or fingerspelling to increase content comprehension and promote group discussions and opportunities for self-expression on specific topics. When an interpreter is used, preteach the vocabulary and agree on signs for specialized content.</td>
<td>5 (86%)</td>
<td>3 (80%)</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Teach step-by-step strategies for problem solving in mathematics but extend beyond drill and practice to math and science processes that require higher-order critical thinking and problem-solving skills.</td>
<td>6 (54%)</td>
<td>4 (74%)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Address the gap between the student's language abilities and the language demands of the textbook and the instructor by scaffolding between the students' reading levels and the chosen materials.</td>
<td>1 (92%)</td>
<td>3 (80%)</td>
</tr>
</tbody>
</table>
RESPONSES TO TWENTY LITERACY AND SCIENCE/MATHEMATICS PRACTICES IN DEAF EDUCATION

Table 4
Number of Master Teachers Expressing Concerns Regarding Literacy, Science, and Math Practices, by Type of Concern

<table>
<thead>
<tr>
<th>Preparation time</th>
<th>Instructional time</th>
<th>Not trained</th>
<th>No material/expense</th>
<th>Disagree with practice</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent reading</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonemic awareness/ Phonics</td>
<td>3</td>
<td>7</td>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Metacognition/ reading strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing to promote reading</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content-area reading</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaborative reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semantic approach to vocabulary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphographemic approach to vocabulary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Science/math practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled communicator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minds-on activities</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Visual organizers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Specialized vocabulary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embedding literacy</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Scaffolding textbooks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When asked to rate the literacy practice of providing and monitoring independent reading activities, 86% of the master teachers indicated that they felt that the practice was clearly beneficial to most beneficial, and 83% indicated that they were very likely to highly likely to engage in the practice. Only 8.4% indicated that they were least likely to engage or might engage in this practice. The primary concern about providing and monitoring independent reading activities was that it was time consuming. Both of the master teachers who commented on the practice were itinerant teachers. It would be useful to know if time constraints are a problem in general for itinerant teachers, or for all teachers. In order to reduce the impact of time constraints, teacher preparation programs need to prepare their students to incorporate time-efficient strategies for including independent reading practices in their routine interactions with students.

When asked to rate the literacy practice of using technology, 76% of the master teachers indicated that they considered the practice clearly beneficial to most beneficial; 70% indicated that they were very likely to highly likely to engage in the practice. Only 9% indicated that they were least likely to engage or might engage in this practice. Several of the participants expressed the caveat that technology should be addressed as a tool that the teacher incorporates into a lesson, not as a primary source of instruction. Other concerns regarding technology pertained to cost and availability. Teacher preparation programs need to provide their teachers in training with sufficient skills in the evaluation of technology and in its incorporation into lesson plans.

When asked to rate the literacy practice of teaching phonemic awareness and phonics, 46% of the master teachers indicated that they felt the practice was clearly beneficial to most beneficial; 45% indicated that they were very likely to highly likely to engage in the practice. Thirty-six percent of the participants indicated that they were least likely to engage or might engage in this practice.

Phonemic awareness and phonics received the most mixed review of all the strategies identified, perhaps because about half of the participants indicated that they worked in programs in which sign language was used and half indicated the use of spoken language, Cued Speech, or some “other” means of communication. The biggest concern expressed by the participants was that they did not have sufficient training to present phonemic aware-
ness and phonics skills and that they did not believe these to be appropriate skills to teach children with hearing loss. Teacher preparation programs must carefully inform their teachers in training of the importance of phonemic awareness and phonics instruction for orally communicating students who are deaf or hard of hearing and of the alternatives for teaching these skills through visual means, such as Visual Phonics (Trezek & Malmgren, 2005). There was sufficient evidence gathered during the literature review described in Task 2 to warrant a careful look at how to teach these skills, how to modify instruction, and for whom the instruction should be modified. Students who are deaf or hard of hearing represent a heterogeneous population, some of whom can learn phonics and phonemic awareness in traditional manners and some of whom need visually oriented modifications.

When asked to rate the literacy practice of teaching metacognitive skills such as the use of reading strategies, 89% of the master teachers indicated that they felt that the practice was clearly beneficial to most beneficial, and 89% indicated that they were very likely to highly likely to engage in the practice. None of the participants indicated that they were unlikely to use practice. Teaching metacognitive skills had the most consistent support among all literacy practices, with master teachers expressing no concerns whatsoever about its use. Teacher preparation programs are encouraged to include metacognitive reading strategy instruction in their literacy programs.

When asked to rate the literacy practice of writing as a tool to teach reading, 89% of the master teachers indicated that they felt the practice was clearly beneficial to most beneficial, and 78% indicated that they were likely to very likely to engage in the practice. Only one of the master teachers indicated that he or she was unlikely to use this practice. Few concerns were expressed, although the issue of the efficient use of time was a factor. Teacher preparation programs need to provide their teachers in training with examples of ways to incorporate writing as a reading tool into their daily activities in an efficient manner.

When asked to rate the literacy practice of using content-area reading materials to promote reading comprehension, 78% indicated that they felt the practice was clearly beneficial to most beneficial, and 83% indicated that they were very likely to highly likely to engage in the practice, indicating strong agreement among the participants. Only 8% of the master teachers indicated that they were least likely to engage in or might engage in the practice. Concerns about the availability of time and resources were expressed. As with writing as a tool to teach reading, teacher preparation programs need to provide teachers in training with examples of ways to incorporate reading in the content areas into their daily activities in an efficient manner.

When asked to rate the literacy practice of having students collaborate on activities that promote literacy development, 62% indicated that they considered the practice clearly beneficial to most beneficial, and 52% indicated that they were very likely to highly likely to engage in the practice. Twenty percent of the master teachers indicated that they were least likely to engage in or might engage in the practice. These findings indicate moderate agreement among the participants on the efficacy of collaborative reading. Even though more than half of the participants supported its use, some concerns were expressed, including the practice’s effectiveness in promoting positive outcomes relative to the amount of time required to do well, the importance of students being at a sufficient cognitive level to benefit from the practice, and the difficulty in forming collaborative groups among a small class of students who tend to be functioning at vastly different levels. Teacher preparation programs need to focus a lot of attention on preparing teachers in training to be able to work effectively with mixed-ability groupings.

When asked to rate the literacy practice of teaching vocabulary meaning through semantically based activities, 89% indicated that they felt that the practice was clearly beneficial to most beneficial, and 89% indicated that they were very likely to highly likely to engage in the practice. Only one individual expressed concern about this practice, in that he or she felt unprepared to teach vocabulary using semantic approaches. Apparently, most of the teachers felt confident using this practice.

When asked to rate the literacy practice of teaching vocabulary meaning through morphographeme-based activities, 65% indicated that they regarded the practice as clearly beneficial to most beneficial, and 64% indicated that they were very likely to highly likely to engage in it. Sixteen percent of the master teachers indicated that they were least likely to engage in or might engage in this practice. These percentages indicate a moderate level of agreement. Concerns were expressed about the lack of preparation on the part of teachers to instruct students in the appropriate manner, the need for students to function at a high cognitive level, and the efficient use of time relative to literacy outcomes. Teacher preparation programs need to provide teachers in training with careful instruction in how to present vocabulary activities that incorporate mor-
phographemic strategies, and they need to prepare teachers in training to do this within mixed-ability groupings.

When asked to rate the literacy practice of incorporating specific activities and strategies to promote reading fluency, 76% indicated that they felt that the practice was clearly beneficial to most beneficial, and 64% indicated that they were very likely to highly likely to engage in the practice. Only 8% of the master teachers indicated that they were least likely to engage in or might engage in this practice—a sign of strong agreement. However, some concern was expressed regarding how the promotion of reading fluency should be addressed with students functioning at different levels. In addition to preparing teachers in training to teach fluency skills both auditorially and visually, teacher preparation programs need to assist them in individualizing instruction.

The two literacy practices that received the most support were the practices of teaching metacognitive reading strategies and teaching vocabulary through semantics-based approaches. The two practices were equally well regarded. These are also two of the strategies that enjoy evidentiary support in the knowledge base (Easterbrooks & Stephenson, in press).

**Results and Discussion:**

**Science/Math Practices**

When asked to rate the science/math practice of being a skilled communicator, 92% of study participants indicated that they felt that the practice was clearly beneficial to most beneficial, and 92% indicated that they were very likely to highly likely to engage in the practice. Only one of the master teachers indicated that he or she was least likely to engage in or might engage in this practice. No concerns were expressed regarding this practice. Being a skilled communicator was one of the highest-rated practices among the science/math practices studied. The support in the literature for teachers being skilled communicators also is undeniably strong. Teacher preparation programs must continue to stress the importance of clear, consistent, and comprehensible communication in the classroom.

When asked to rate the science/math practice of presenting concepts in the student's first language before presenting them in the second language, 78% indicated that they felt that the practice was clearly beneficial to most beneficial, and 80% indicated that they were very likely to highly likely to engage in the practice. No major concerns were voiced regarding this practice, with the exception of comments by three teachers whose students presumably relied on spoken language. With the ever-increasing population of deaf and hard of hearing students whose home language is not English, it is critical that teacher preparation programs focus on issues of cultural sensitivity and the impact of multiple languages on a child's communication and academic development.

When asked to rate the science/math practice of possessing specific training, experience, and certification in content-area knowledge, 54% indicated that they felt that the practice was clearly beneficial to most beneficial, and 60% indicated that they were likely to highly likely to engage in the practice. In their written comments, master teachers tended to express strong yet contradictory opinions. The statement, "I am a skilled learner/teacher and I have the ability to teach any content well and learn it on my own in order to teach it," sums up the opinions of those who did not feel the need for additional credentials in content areas. The statement, "I must use the resources of other teachers, Internet tools, and local staff development, as science and math are not necessarily the areas which I feel the most confident teaching," lends support to the present push to require all teachers to become highly qualified in the content areas they teach, as manifested by the No Child Left Behind Act. Whether one embraces or eschews the concept of "highly qualified," it is nonetheless a mandate, and teacher preparation programs must support their students' acquisition of content-area knowledge.

When asked to rate the science/math practice of enhancing content mastery through the use of minds-on activities and materials, 84% indicated that they felt that the practice was clearly beneficial to most beneficial, and 80% indicated that they were likely to highly likely to engage in the practice. Two of the participants felt that they did not have the skills necessary to use this practice efficiently. Frustration over this lack of comfort was summed up by the participant who stated that "I feel like one student or I end up doing all the thinking. Or I end up having to give them the answers. Usually one or two students are capable of reasoning things through and the remainder of the students end up copying the answers." There is an abundance of literature indicating that students who are deaf or hard of hearing need to learn critical thinking skills through real-world, minds-on activities (Easterbrooks & Scheetz, 2004; Martin, 1993; Martin, Craft, & Sheng, 2001). Teachers need sufficient training in the stages and types of higher-order cognition so that they know how to account for multiple levels within a class.

When asked to rate the science/math practice of enhancing content mastery through the use of visual organizers, 92% indicated that they regarded the practice as clearly beneficial
to most beneficial, and 97% indicated that they were likely to highly likely to engage in the practice. In fact, using visual organizers was the top-ranked practice among all of the master teachers. Only one teacher was neutral on the topic; none were opposed to the practice. This finding lends credence to this much-discussed but poorly documented practice. Teacher preparation programs should continue to promote the use of visual organization tools.

When asked to rate the science/math practice of teaching science concepts by incorporating a collaborative, case-based, problem-solving approach, 78% indicated that they felt that the practice was clearly beneficial to most beneficial, and 71% indicated that they were likely to highly likely to engage in it. Two major concerns were indicated, in both the rating section and the comments: time constraints on teachers and more pressing issues of literacy and language. This theme has been expressed previously under other practices, and lends further support to the need for teacher preparation programs to address the time constraint issue.

When asked to rate the science/math practice of using technology that is known to be motivating, 86% indicated that they considered the practice clearly beneficial to most beneficial, and 74% indicated that they were likely to highly likely to engage in the practice. The concerns that were expressed related to previously mentioned challenges related to time constraints and the challenge of working with students at different levels, underscoring the need for teacher preparation programs to address these concerns.

When asked to rate the science/math practice of teaching science and math using “specialized content vocabulary,” 86% indicated that they felt that the practice was clearly beneficial to most beneficial, and 80% indicated that they were likely to highly likely to engage in it. Five of the master teachers noted that they either served oral students who did not use sign language interpreters or did not teach science, math, or social studies. It is possible that the question was written in a confusing manner so that these individuals misinterpreted the question as pertaining only to signing students. In fact, the intent of the practice is to provide for preteaching of specialized vocabulary concepts, whether in spoken or signed form. However, when the concept is signed, there should be consistency in the sign used among all service providers.

When asked to rate the science/math practice of teaching strategies that require higher-order critical thinking and problem-solving skills, 54% indicated that they considered the practice clearly beneficial to most beneficial, and 74% indicated that they were likely to highly likely to engage in the practice. While three fourths of the master teachers agreed that they were likely to use this practice, it seems anomalous that only about half reported that they saw it as beneficial. This begs the question as to why someone would use a practice that he or she did not see as beneficial. One master teacher summed up the situation with the statement that “I cannot do this as a whole-group activity. I leave behind a large portion of my class who end up just going along for the ride and learning nothing. If I do use this approach, I assign it as homework to those specific students that will benefit from doing this.” This discrepancy appears to be related again to teachers’ frustrations about handling mixed-ability grouping.

When asked to rate the science/math practice of using scaffolding to bridge between the language demands of the textbook and the instructor and the students’ language skills, 92% indicated that they felt that the practice was clearly beneficial to most beneficial, and 80% indicated that they were likely to highly likely to engage in the practice. The high ratings for scaffolding reflect the constant challenge that teachers face in mediating content in print matter for students. The concerns that were expressed pertained not only to the time that would be needed for preparation but to the reduction in direct instruction time that would result.

Three science/math practices received equal support from the master teachers in regard to their benefit to students: using visual organizers, being a skilled communicator, and using scaffolding. These three were ranked by likelihood of use as first, second, and third, based on numbers of teachers rating the practices.

Themes That Emerged From a Review of Survey Responses

Several themes emerged clearly from the benefit/likelihood ratings, the concerns ratings, and the written comments made by the 37 master teachers. An important concern, reflected in responses concerning 12 of the 20 practices, was the time constraints under which teachers of the deaf work. Many of the master teachers expressed frustration with the increasing demands of the job in the face of mixed-ability groupings, time-intensive service delivery models, and restrictions placed administratively on what must be taught. This is especially troubling given the available research that documents the negative impact of insufficient time on the performance of students who are deaf or hard of hearing (Limbick, McNaughton, & Clay, 1992; Luckner & Isaacson, 1990). Teacher preparation programs must address time pressure issues with teachers in training and assist them in designing
schedules that allow them the time needed to use effective strategies. It is very challenging for many teachers of the deaf to provide for all of their students' needs, given the structure of schools today. One way in which researchers might help with this dilemma is to identify those practices that provide the maximum outcome for the minimum time. These data are not presently available and would be extremely helpful in guiding teachers of the deaf toward making maximally efficient use of their time.

A second prominent theme was the influence of mixed-ability groupings on the ability of a teacher of the deaf to apply a practice. Today, most teachers of the deaf have mixed-ability groups of students, often with multiple languages and communication modalities. The master teachers in the present study appeared to be very willing to use any strategy that was appropriate and expressed distinct concerns when they were not comfortable with a practice, but the challenges of handling all these possibilities in the face of mixed-ability groups was of great concern. Teacher preparation programs must ensure that their teachers in training are receiving sufficient experience in modifying instruction to meet the diverse needs of these challenging classrooms. One way to address this might be for researchers to determine whether some practices are more effective than others for students in various states of readiness.

**Limitations of the Study**

As with any study in deaf education, teachers' belief systems may have had an impact on the results. We chose not to compare results between teachers based on their belief systems, as this would only perpetuate a problem in the knowledge base of deaf education: the "us versus them" frame of reference. There are thousands of articles in the knowledge base supporting one communication modality and philosophy over another. Relative to the handful of research articles providing direct evidence in support of appropriate instruction, we appear to have beaten the proverbial dead horse. It would be more helpful to investigate how best to make instructional practices work in all classrooms.

A second limitation of the present study pertains to the limited number of responses to the survey. "Nonresponse bias occurs when the observed value deviates from the population parameter due to differences between respondents and nonrespondents. Nonresponse bias is likely to occur as a result of not obtaining 100% response from the selected cases" (National Center for Education Statistics, 2002). The fact that the survey participants were individuals designated by their colleagues as master teachers may reduce some of the nonrespondent bias, as only those teachers who were reputed to be highly skilled were asked to participate. A corollary limitation to this is that novice teachers may have responded differently to the practices.

**Summary**

As part of a federal grant to improve outcomes for students who are deaf or hard of hearing, ACE-DHH constituted a team whose task it was to identify content standards and their associated instructional practices. The present article provides a summary of that task as well as the results of master teachers' reflections on the practices. Content standards in all states were reviewed, and a summary table of agreement among the states was presented. Results of master teachers' reviews of 20 practices, 10 each in literacy and science/math, indicated a high level of agreement about the benefits and likelihood of use of these practices. Concerns over how to fit all the practices into a busy schedule and into mixed-ability classrooms were themes of the reviews. Recommendations for actions by teacher preparation programs were made.

One final comment pertaining to the nature of research in the field of deaf education is warranted. There is a large database identifying the pros and cons of the various communication modalities and philosophies as well as the issues involved in their application. This research far exceeds that which is available on literacy and content-area instruction. The field would benefit greatly from a research summit in deaf education to chart the course for research into appropriate instruction. This would focus attention on those areas that need substantial research, perhaps leading to increased support for research from various funding agencies.

**Note**

The contents of the present article were developed under a PT3 grant (Join Together, P342A030098) from the U.S. Department of Education. However, the contents do not necessarily represent the policy of the Department of Education, and the reader should not assume endorsement by the U.S. government.—The Authors.

**References**


