**Unified English Braille (UEB): The Transition to UEB**

**and Its Impact Across the United States**

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Key objectives:

* Summarize the data acquired/trends identified from teachers of students with visual impairments (TSVIs), braille transcriptionists and paraprofessionals, university personnel preparation faculty, parents and local education administrators specific to the impact of the transition to UEB across the United States (US), including:
	+ Support provided to the respondents prior to the implementation of UEB.
	+ Barriers (resolved, ongoing, and new) experienced while preparing to teach UEB.
	+ Factors that impact teachers' perceptions of UEB usability.
	+ Resources needed to better prepare respondents to provide UEB instruction.

**Introduction**

On January 4, 2012, the Braille Authority of North America (BANA) formally adopted the comprehensive Unified English Braille code (UEB) in the United States with an implementation date of January 4, 2016 (BANA, 2012). While the original intent of the adoption was that the United States and its territories (US/Terr.) would transition to UEB, major stakeholders in the braille community could not reach a consensus on a single standard code for technical materials (e.g., Math, Science, etc.) (BANA, 2015). It was determined that the US/Terr. would implement UEB Technical Materials (also referred to as UEB Math/Science) while maintaining “the powerful and efficient system” the Nemeth Braille Code for Mathematics and Science (BANA, 2012). The decision to use and teach UEB (or UEB Math/Science), or what is now referred to as Nemeth within UEB Contexts, would be based on individual student needs (BANA, 2015).

To date, very little research has been conducted since the US/Terr. transition to UEB. In 2017, one year after the identified implementation date for UEB, Hong et al. (2017) surveyed 141 TSVIs across 28 states on their experiences surrounding the transition to UEB. The survey consisted of 17 sections and 126 questions. Results from the survey revealed that a significant number of TSVIs did not feel that they had been offered or received adequate UEB Math/Science instruction nor did they receive the necessary implementation guidance from their states and individual school districts to know how to best transition or if they should transition their students to UEB Math/Science. While several TSVIs reported being aware of their state's implementation plan, few attended the offered workshops and, given their lack of preparation, many reported low confidence in teaching UEB Math/Science compared to the literary components of UEB.

While the findings of the 2017 study capture a glimpse of the real-world struggles of TSVIs, the study was completed only one year after the official transition, when resources and instruction were limited. The results from the 2017 study are not only outdated but represent only a fraction of the people involved in this transition. Additionally, given the extensive questionnaire, researchers could not capture a complete response to all questions from all survey respondents, making it difficult to interpret the actual needs of TSVIs and others involved in the nationwide transition.

Despite BANA's direction to implement the comprehensive UEB code while maintaining Nemeth within UEB Contexts, individual states chose to identify one math/science braille code as their “default” code. Given the ongoing inconsistency and confusion specific to the transition to UEB, particularly UEB Math/Science (D'Andrea, 2015; NFB, 2015), our research sought to identify what supports were provided to individuals prior to and during the transition to UEB and what supports and resources continue to be needed. Specifically, our research sought to ask the following questions hoping to acquire information that would direct next steps and future research. First, what supports (e.g., professional development, etc.) were provided to the respondents across the US/Terr. by state educational entities and local agencies to prepare relevant individuals for the transition to UEB? Second, what ongoing barriers (e.g., lack of resources, accessibility of state and national college entrance exams, etc.) are impacting the instruction and transcription of UEB? Third, what factors (e.g., misunderstandings, biases, etc.) are influencing perceptions specific to the instruction and use of UEB Math/Science across the US? Fourth, what resources are needed to improve UEB instruction, including UEB Math/Science?

Our overall goal was to share the data collected from respondents based on their experiences before, during, and after the transition from English Braille American Edition to Unified English Braille (including Nemeth Code within UEB Contexts) to bring awareness to ongoing concerns and guide research towards the next best step.

**Methods**

**Participants and Recruitment**

Approval to conduct the research was obtained from the Institutional Review Board at the University of Utah. Informed consent was obtained from all respondents. The survey was open to teachers of students who are blind or visually impaired (TSVIs), braille transcriptionists and paraprofessionals (braille transcribers), university visual impairment personnel preparation faculty (university faculty), parents of students who are blind or visually impaired (parents), and local school administrators (administrators). Respondents were recruited through announcements on social media platforms, e-mail listservs, and word of mouth beginning in the spring of 2023. Respondents were recruited starting in March 2023 through November 2023.

**Procedures**

 Five parallel online surveys were developed using an online survey tool, specifically, a survey for TSVIs, braille transcribers, university faculty, parents, and administrators. Each survey requested respondent basic demographic information (i.e. title or position, state or territory in which they live, etc.). Following the collection of the non-identifying demographic data, all groups were asked questions regarding their knowledge of a state or territory specific UEB implementation plan, opportunities for professional development provided prior to the transition, factors specific to their use and perception of UEB Math/Science (i.e., support, barriers, etc.). All data collected from the surveys were carefully analyzed and then evaluated. Surveys were marked as “included” if they were completed in full.

**Data Collection**

Given the voluntary nature of online surveys, not everyone who received the study completed it in full. To ensure reliability, 215 surveys across the entire study were excluded from the analysis because they were incomplete or opened and immediately closed. The researchers reviewed and coded the five survey groups separately before comparing data across groups. Given the responses from each group, focus group interviews were conducted to gain additional information from willing participants. Finally, all data was analyzed and compared across groups. Given analysis of the data, the researchers identified common trends from respondents and areas of need for future research.

**Results**

A total of 267 relevant individuals (TSVIs = 137, braille transcribers = 51, university faculty = 15, parents = 33, administrators = 31) completed the online survey(s) in full in the spring through winter of 2023. Respondents include individuals from 42 states and 2 US territories (Guam and Puerto Rico). Given the responses from all survey groups, key themes were identified and will be discussed within the remainder of this paper.

**Supports Provided Prior Unified English Braille Implementation (Question 1)**

 Within each of the five surveys distributed, respondents were asked to identify whether support in the form of professional development (i.e., workshop, etc.) was provided by state educational entities or local agencies prior to the transition to UEB, whether they participated in the offered professional development, and whether they sought out additional courses or materials on their own.

Respondents noted that not all state education entities or local agencies provided professional development prior to the official implementation of UEB in 2016. For those states that did provide professional development, an average of 55% of respondents participated. Most respondents indicated that, in addition to or in place of professional development offered by the state or local entities, they sought out courses and materials online on their own time.

Respondents noted that professional development provided by state educational entities and local agencies included workshops and trainings prepared or hosted by state schools for the blind, educational resource centers, state departments of education or university personnel preparation programs, sessions and classes hosted by state AER chapters, etc. Respondents who sought out additional courses/online materials noted accessing one or more of the following:

* Braille Authority of North America website resources (brailleauthority.org)
* Project Inspire ([www.pathstoliteracy.org/courses (currently focuses primarily on Nemeth within UEB Contexts)](http://www.pathstoliteracy.org/courses%20%28currently%20focuses%20primarily%20on%20Nemeth%20within%20UEB%20Contexts%29))
* The Hitchhiker’s Guide to UEB Mathematics (UEB Curricula Support Writing Group/banzat.org.nz)
* UEB Literacy & Mathematics Braille Training (UEBOnline.org)
* UEB Math Tutorial (American Printing House for the Blind/uebmath.aphtech.org)
* UEB Technical: Algebra and Geometry (Basic) (National Braille Association/nationalbraille.org)
* Unified English Braille Online Training (UEBOT) (Northern Illinois University/uebot.niu.edu)
* Unified English Braille (UEB) Transcription Course (Canadian National Institute for the Blind (CNIB) Foundation/CNIB.ca)

While these resources provide helpful information regarding the differences between EBAE and UEB (primarily focused on the literary code), examples and possible instructional strategies, many respondents indicated ongoing barriers that continue to impact their support of UEB Math/Science.

**Barriers Experienced within the Unified English Braille Transition (Question 2)**

Having transitioned to UEB eight years ago, we sought information regarding barriers that may have been experienced prior to the transition and whether those barriers continue and/or new barriers are being experienced. Respondents noted several barriers including: limited or no professional development opportunities preparing them for the transition to UEB, difficulty accessing UEB resources/materials, difficulty accessing student textbooks/materials in UEB, difficulty accessing state, advanced placement, or college-level assessments in UEB, and difficulty determining whether time was available to transition high school-aged students to UEB prior to graduation. Most respondents agreed that these key barriers continue to impact their state’s/territory’s complete transition to UEB.

TSVIs and university faculty clearly noted that the limited available materials (e.g., textbooks, comprehensive and accessible reference sheets, resources specific to UEB Math/Science, additional formatting guidelines, etc.) and supports (e.g., professional development opportunities) continue to contribute to barriers specific to preparation for student instruction in UEB. The fact that these barriers continue eight years after the transition and continue to impact TSVIs and students is very concerning with TSVIs and university faculty indicating that they are left to determine whether it is feasible for them or their students to learn UEB Math/Science. The lack of support (physical and material) continues to be a top contributor to teachers' willingness to accept UEB and learn the code, let alone to teach to their students. In addition, a few respondents noted that these barriers may have contributed to their states beginning their transition after 2016 or taking several years to make a complete transition. While the barriers continue, there are additional factors that respondents have also impacted their perceptions specific to UEB.

**Factors that Impact Perceptions of Unified English Braille Usability (Question 3)**

 Results from the survey identified several common factors across all respondent groups regarding the usability of UEB. Most respondents noted positive perceptions regarding the transition to UEB while indicating ongoing frustration with implementation guidance supporting the use of two distinct math braille codes. Many respondents noted the opinion that the US/Terr. should pick one code to reduce confusion and increase materials and support.

Respondents' views varied across all five surveys specific to the ease of learning and teaching the UEB code. While those within the US/Terr. are able to access several supports and materials online, many resources reference each other, use the same examples, are difficult to find or navigate, etc. This is unsurprising given the ongoing maintenance of two codes and the limited UEB resources, information, and training.

In responding to the questions regarding what math braille code (or codes) is currently being taught to students by TSVIs and taught/used by university faculty, and parents, the respondent's current understanding, perceptions, or concerns specific to the comprehensive UEB code are very influential. These respondents noted too many unknowns specific to the comprehensive UEB code. The main concerns stem from limited data and research on UEB Math/Science, in addition to well-known biases when considering higher-level mathematics. For this reason, many chose to continue teaching the Nemeth code. This seems especially true for those students who anticipate needing higher-level mathematics in high school, college, or careers.

TSVIs also noted that their comfort level in teaching the UEB Math/Science and availability of resources/materials to support their learning and instruction as determining factors in whether they would teach the code to their students. For TSVIs and university program preparation faculty, opportunities to participate in professional development continue to be a major factor contributing to the negative perceptions of UEB. For many, their knowledge and skills are based on years of teaching Nemeth. Without appropriate instruction provided prior to the transition and ongoing professional development opportunities to provide up-to-date information, it is easy to see why many continue to use Nemeth with little consideration for UEB Math/Science.

Parents also noted the influence of consumer organizations (specifically, the opinions of blind professionals) within conversations about advanced mathematics and science careers. Parents are aware of the opinions of adults who are blind specific to UEB Math/Science and they, themselves, are concerned about the unknowns of UEB Math/Science and its functionality in advanced higher-level math. As a result, many parents prohibit their students from learning the UEB Math/Science code.

Multiple factors influence the decision on which code (UEB Math/Science or Nemeth within UEB Contexts) is taught to a student. Factors included state “default” code, individualized education program (IEP), materials/curriculum availability, teacher preference, student preference, parent preference, student age, consumer influence and other. Given the many different perspectives surveyed, it is not surprising that there is little agreement across each group as to which factor has the more significant influence. With so many factors and perspectives to consider in addition to the US/Terr. lacking materials and support for UEB Math/Science, students are the ones who ultimately pay the cost.

**Identified Resources to Improve Unified English Braille Instruction (Question 4)**

As noted above, most respondents reported accessing state and university materials, workshops, courses, or online materials and resources to learn and teach UEB (to students, teachers, and everyone in between). Respondents also reported an ongoing need for the following.

First, a textbook focusing on UEB Math/Science, the mathematical skills learned by students of all ages, and ample examples of how materials should be transcribed for students (including guidance on formatting specific to BANA Braille Formats). A textbook that could be used within university personnel preparation programs or by TSVIs seeking additional guidance might provide the guidance and understanding needed to move more individuals toward teaching UEB Math/Science. Additional guidance and resources (including textbooks, online materials with applicable examples for all mathematical situations and symbols, etc.), as well as training for TSVIs, are critical for the success of UEB Math/Science. This additional support would not only boost TSVI and university faculty confidence in the code but also help parents feel more secure in their students being successful with learning and using UEB Math/Science throughout their schooling and careers.

Second, additional and ongoing professional development for teachers and others to increase and support their knowledge and learning of UEB Math/Science. Third, research on student success using UEB Math/Science in higher-level mathematics. The information acquired from respondents has provided valuable insights into the ongoing issues being experienced by all individuals, including students.

**Discussion**

This study's results confirm ongoing issues stemming from the initial transition to UEB in 2016 and BANA’s decision for the US/Terr. to maintain the Nemeth braille code. The key themes identified across the responses include, a need for ongoing professional development and additional materials/resources to support UEB (especially UEB Math/Science) instruction.

Many respondents reported being provided with varying levels of professional development (critical training and information) through their state department of education, school for the blind, or other entities specific to UEB Math/Science and instructional strategies. Most respondents indicated seeking out courses and materials online on their own time to support their learning UEB. However, despite efforts to learn independently and seek support, many online materials do not provide in-depth instruction or a wide variety of examples to support effective instruction in UEB Math/Science. Resources remain limited, lack varied critical examples, and require individuals to search across several websites for basic braille symbols and formatting guidelines. Given the limited resources, information, and training, many individuals across the US/Terr. continue to experience frustration as they seek to learn and teach the comprehensive UEB code.

**Limitations**

There are several limitations in the research and results to consider. All responses were self-reported with no ability to verify the responses as true or unbiased unless an individual volunteered to participate in the optional post-survey focus groups. Verification of responses, to a limited extent, were integrated into the questions asked within the post-survey focus groups. While we tried to make this survey succinct and clear, it is possible that some respondents may have grown tired or opted out of taking the survey due to the busy time of year. Data is not respective of experiences of all individuals across all states, especially given that responses were not received from eight states. In addition, we recognize that the experiences of individuals within and across states may have been varied given location, time commitments or professional development offered.

**Recommendations for future practice and research.**

In the eight years since transitioning to UEB, many individuals across the US/Terr. took the necessary steps to learn and understand UEB. Regardless of the learning completed to date, ongoing learning/ understanding is needed to ensure students receive up-to-date and accurate instruction in appropriate braille codes (e.g., UEB, Nemeth within UEB Contexts, Music braille, etc.).

Recommendations for future practice include the identification of in-person, virtual (e.g., Zoom or Teams), or online training opportunities to support the ongoing learning of TSVIs and others in the modality that best meets the needs of the individuals. Multiple modalities are needed to best support the learning of those who prefer independent online learning, those who prefer in-person, hands-on learning opportunities and those who live in rural communities. Individualized Education Program (IEP) teams need to carefully consider the actual needs of each student prior to identifying the “best” Math braille code for the student and not base the decision on a state identified “default” code, teacher preference, or availability of materials. The US/Terr. needs to identify additional support(s) and funding that will allow professionals the time necessary to create a textbook and other materials with a variety of examples to better meet the needs of TSVIs and students.

Recommendations for future research include a significant need for research on student success with UEB Math/Science and Nemeth within UEB Contexts. UEB is a new code compared to the Nemeth Braille Code for Mathematics and Science Notation (a code formally adopted by BANA as the standard code to represent mathematics and scientific notation in 1952, over 72 years ago). Research on both codes is needed to better identify students' potential for success regardless of the code chosen. Ongoing research is also needed to better determine TSVI understanding of the braille codes and identify potential implications specific to student instruction. Finally, increased research is sorely needed relative to the current level of preparation provided to TSVIs and the success of their students in learning and using braille.

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