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Development of *4to24*, a Transition App for Parents of Students with Visual Impairments

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Abstract

Introduction: This article focuses on the development of *4to24*, an informational app for parents of students with visual impairments, with emphasis on obtaining stakeholder input, developing content, and establishing content validity. The app provides information, resources, and activities to help students, ages 4 to 24 years, prepare for independence and employment as an adult.

Methods: App design and content development involved multiple phases of iterative design and writing. Stakeholder input was obtained via an advisory board and user focus groups with parents and students. Experts reviewed and validated content with ratings and recommendations on accuracy, age-appropriateness, and relevance.

Results: Advisory board members identified important domains to address in *4to24* including social skills, technology, travel skills, health and fitness, independent living, career education, and self-determination. They recommended focusing on elevating parents' expectations and confidence in supporting and teaching their children. Focus group participants recommended accessibility, ease of use, and relevant information to make the app appealing to users. The content validation process supported the content's relevance, accuracy, and age-appropriateness and resulted in a final count of 410 informational modules.

Discussion: Parent involvement and expectations are critical to students' preparation for future employment. *4to24* provides support for parents to collaborate with service providers and reinforce concepts and skills outside of school. Development of the app technology and its large volume of content required a full 5-year process.

Implications for Practitioners: Lessons learned from this project can inform future resource development projects, including recommendations to start small and define goals early in the

process. The *4to24* app is a new resource for parents of students with visual impairments that can supplement services provided by professionals.

Development of *4to24*, a Transition App for Parents of Students with Visual Impairments

Employment rates for adults with visual impairments (i.e., individuals who are blind or have low vision) have been lower than those of people without disabilities for many years (Kraus et al., 2018; McDonnall & Sui, 2019), which is often attributed to barriers to employment that are faced by this population (Coffey et al., 2014; Crudden & McBroom, 1999; Kirchner et al., 1997; McDonnall et al., 2013). Similarly, youth with visual impairments have far lower post-school employment rates than youth without disabilities (McDonnall, 2010b; Newman et al., 2011). Although the transitions from adolescence to adulthood and from education to a career are challenging for all youth, they require special considerations for youth with visual impairments. As recognized in the Expanded Core Curriculum (ECC; Hatlen, 1996; Sapp & Hatlen, 2010), many aspects of concept and skill development require a deliberate approach for students with visual impairments. For young people, achieving those skills and developmental milestones at the stages comparable with their peers could increase the likelihood of successful employment and independence as an adult (Cmar, 2015; McDonnall, 2011; McDonnall & Crudden, 2009; Wolffe & Kelly, 2011; Zhou et al., 2013). Beginning transition preparation before the age of 16 can be beneficial for students with visual impairments, with ECC instruction recommended starting in early childhood (Allman & Lewis, 2014; Nagle, 2001; Wolffe, 2007; Zabelski, 2007). Parents and families play a crucial role in the transition to adulthood for youth with visual impairments in setting expectations and providing and advocating for learning opportunities (Zabelski, 2007). High levels of parental involvement, expectations, and support are associated with positive post-school employment outcomes for youth with disabilities, including visual impairments (Mazzotti et al., 2016; McDonnall, 2010a; Test et al., 2009). Conversely, parental overprotection, low or unrealistic expectations, and lack of information about services may limit

independence and adversely impact post-school outcomes (Lindsay et al., 2015; Munro et al., 2016; Riesen et al., 2014). Providing information and resources to parents about supporting their child's development beginning at an early age can be important for the child's future success. With the current prevalence of smartphones and tablets, mobile application (app) use, and widely available Internet access, providing information via a mobile app can reach more parents and youth than by using other means. Increasing use of apps is illustrated by the recent development of two other apps specifically for youth with visual impairments for practicing academic skills (Beal & Rosenblum, 2015; Kamei-Hannan et al., 2020). Apps also offer the use of active reminders, like notifications in an app-based calendar, that have been shown to increase desired activities to a higher degree than passive reminder systems (McDonald et al., 2011). With these factors in mind, an intervention development project was undertaken to create an app for parents of students (i.e., children, youth, and young adults) with visual impairments to provide them with accessible, user-friendly information, activity suggestions, and resources for supporting their child's development, preparation for employment, and independence over time. The app, called *4to24*, is intended to supplement and support the education and instruction provided by service providers and empower parents through knowledge and encouragement to be a positive influence on their child's growing independence.

This article covers the overall *4to24* app concept and development timeline, with particular focus on the processes of obtaining stakeholder input and developing valid content. The project aims for these phases of the development process were to:

1. Obtain initial input from stakeholders on the overall concept of the app and important content to include through an advisory board meeting and focus groups with parents and students.

2. Develop content for students and families to support students in concept and skill development in all areas important for future employment.
3. Establish content validity with service providers and end users.
4. Integrate final content into the app with consideration of stakeholder input.

Development Process

Procedure

We obtained stakeholder input at multiple stages of this project, which influenced the iterative development process. Technical design of the app and content development took place concurrently over 5 years, and each informed the design and planning of the other. See Figure 1 for a timeline of the development process. Descriptions of the technical development, usability testing with students and parents, and field testing with students and parents will be included in future articles.

Aim 1: Obtaining Stakeholder Input

Advisory Board

At the beginning of the development process in late 2015, key stakeholders provided input on content areas to include in the app during an advisory board meeting. Advisory board members ($n = 5$) included two education and vocational rehabilitation (VR) professionals, two parents of students with visual impairments, and one young adult. The young adult and one parent had a visual impairment. Three advisory board members were male, and two were female. The group met via teleconference for approximately 1.5 hours, and two researchers facilitated the meeting. The meeting began with introductions, followed by an overview of the project and a description of the app's target audience, function, and design. Advisory board members then provided input on the broad content areas they thought the app should address. The meeting was audio-recorded,

and the researchers took detailed notes during the meeting. After reviewing the recording and meeting notes, the researchers developed a list of topic suggestions and shared it with the app content writers.

Advisory board members acknowledged the importance of addressing the nine areas of the ECC and the five primary activities of pre-employment transition services identified in the Workforce Innovation and Opportunity Act (WIOA; 2016): job exploration counseling, work-based learning experiences, counseling on opportunities for transition or postsecondary education programs, workplace readiness training, and self-advocacy instruction. They recommended including content in the broad domains of social skills, technology skills, orientation and mobility (O&M), health and fitness, independent living skills, career education, and self-determination. Under independent living skills, specific topic suggestions included personal and home management, grooming and self-care, eating and dining skills, and financial literacy. Under career education, suggestions included career awareness, chores, career exploration, volunteering, job-seeking skills, disability disclosure, role models, and mentoring. Recommendations related to self-determination included self-awareness, self-esteem, self-advocacy, problem solving, and goal setting.

Advisory board members also provided several overarching recommendations that spanned multiple domains. They felt that the app should aim to improve parents' expectations and reduce fear related to their child's learning and development. Suggestions included building parents' confidence in their ability to teach and support their child, helping parents believe that their child can accomplish things, and exposing parents to competent blind people. Advisory board members emphasized the importance of supporting students' independence, increasing their self-confidence, and helping them identify when to ask for assistance. They recommended providing

information and resources related to advocacy, parent organizations, consumer groups, programs and services for students with visual impairments, VR agencies, career centers, and workforce development systems. They recommended considering culture and language when creating content for the app.

Focus Groups

During summer of 2016, focus groups were conducted with students and parents of children with visual impairments to obtain input from potential users about the functionality and, for parents, areas of content they would like to see in the app. All participants had to be smartphone users, and parents had to have a child between 4 and 24 years of age. Student participants had to be between the ages of 14 and 24 years and have a visual impairment. The Institutional Review Board at Mississippi State University determined that these focus groups did not meet the regulatory definition of research (Protection of Human Subjects, 2009) because their purpose was to inform the design of a product rather than contribute to generalizable knowledge; therefore, they did not require Institutional Review Board oversight. All participants received a \$20 incentive for participating.

Separate focus groups were held for parents and students. Parents were recruited via advisory board members, national visual impairment consumer conferences, and an online registry. Five parents participated; all were female and had children with visual impairments ranging in age from 9 to 19 years. The parent focus group had three attendees and was conducted via teleconference. Because all parent participants were not available at the same time, two parents completed separate individual interviews, one in person and one by phone. Moving forward, the term *focus groups* includes these individual interviews. Students were recruited

from a summer camp at a residential rehabilitation facility in the southern United States. The student focus group had 10 attendees, five males and five females, and was conducted in person.

Two researchers conducted each focus group: one led the focus group protocol, and the other managed the recording equipment and took field notes. The focus group protocol included a welcome and introductions, an overview of the app concept, and questions about how the app should function and where participants received information about transition. Parents received additional content-related questions. See Table 1 for the list of questions. The focus groups were audio-recorded and transcribed. Researchers reviewed and summarized the transcripts and field notes and shared the summaries with the app content writers and framework designers.

Parent and student participants shared similar feelings on the app's concept, length of initial setup, and overall impressions. Participants noted the following features that would make the app appealing: accessibility, ease of use, providing relevant information, limiting the frequency of notifications, and connecting with local agencies. Most participants believed that the app profile setup should not take very long, maybe 5 to 10 minutes.

The participants reported that young people typically begin using their own smartphone at varied ages; responses ranged from age 5 to age 18 across students and parents. Most participants liked the overall idea of the app; however, some found it hard to conceptualize. Participants also believed the app would be a resource to find information they do not receive from other sources. Both groups stressed the importance of data security, and the students encouraged beta testing the app before releasing it to the public.

Parents identified multiple topic areas to address in the app based on concerns for their own child's development, including social skills, puberty, and independence. Specific areas of concern for post-school employment included self-advocacy, accommodations, and

transportation. Other themes specific to post-school employment were managing Supplemental Security Income while working and having job experience and volunteer opportunities.

Aim 2: Developing Content

Initial content development took place in 2016 through early 2017. Several sources informed the app content, including recommendations from advisory board and focus group participants, the transition activity calendar (LeJeune & Orr, 2011), other transition checklists, and literature related to employment for students with visual impairments. Four writers developed the content, including two researchers and two external consultants. The writers were female, sighted, and had expertise and experience in the blindness field, with backgrounds in teaching students with visual impairments, O&M, vision rehabilitation therapy, early childhood, and transition.

In early 2016, the writers worked with the development team to create a spreadsheet (i.e., content map) to plan the content's progression from ages 4 to 24 within and across several broad topic areas. Content map development was an iterative process that involved multiple rounds of editing to ensure thoroughness and reduce redundancy. Each topic area in the final content map had approximately three to four items per age that represented key age-appropriate concepts or skills.

The development team assigned topic areas and age ranges to the writers based on their areas of expertise. The writers then developed informational modules for their designated topics and ages. Each module was approximately two to three pages long (single-spaced) and included the following sections: overview, more information, suggested activities, references, and resources. Methods for promoting consistency across writers included providing sample modules, using a template, establishing file-naming conventions, and providing terminology and reading-level guidelines. This phase of the development process resulted in the production of 398 modules

across 10 categories (see Table 2).

Aim 3: Establishing Content Validity

In 2016 to 2017, a team of experts (i.e., content validators) read the modules, rated them, and provided detailed feedback. The content validators ($n = 5$) included two education and VR professionals, two parents of children with visual impairments, and one young adult with a visual impairment; three were female, and two were male. Three validators (the two professionals and one parent) had also participated in the advisory board meeting.

The validators reviewed each module in Word format and completed a content validation form, administered through an accessible web-based survey platform. They responded to four items for each module: (a) Rate overall topic (essential; important, but not essential; optional; not relevant); (b) Is content age-appropriate? (yes/no); (c) Is content accurate? (yes/no); and (d) Do you suggest any changes or additions? (yes/no). Each item had a corresponding open-ended text-entry field, in which validators could explain their responses and provide recommendations. Four validators reviewed 100% of the modules and received a \$750 honorarium after completing the review. The fifth validator reviewed 74% of the modules as part of a college class internship. Using SAS version 9.4, we generated descriptive statistics (i.e., frequencies and percentages) to summarize the quantitative ratings for each module. We exported the open-ended responses to a spreadsheet for analysis. At least two team members reviewed and coded all comments for each module.

Table 3 provides the validators' ratings of relevance, age-appropriateness, and accuracy for the 398 modules. Across categories, the validators rated 94% of the topics as "essential" or "important" and approximately 6% as "optional" or "not relevant." The validators rated most

content as age-appropriate; ratings ranged from 89%-100% by category. Similarly, the validators rated most content as accurate; ratings ranged from 88%-98% by category.

After a holistic review of the quantitative and qualitative data for each module, team members classified each comment as follows: (a) no action; (b) simple change (i.e., one person could resolve it); (c) review (i.e., required follow-up or review by a second person); or (d) staff (i.e., required discussion by multiple team members, substantial revisions, or expert consultation). Comments requiring *no action* typically indicated agreement about the topic's importance, explained the rating, or included general statements about the content without specific recommendations. Comments classified as *simple changes* comprised suggestions for minor editorial revisions, recommendations for reducing technical or academic language, ideas for expanding activities, and suggestions for new activities or resources. Comments coded as *review* or *staff* included topics to emphasize more (e.g., braille, math, science), requests for additional references, and concerns about age-appropriateness or relevance. Some of these comments addressed potential familial or cultural concerns regarding how and when to address topics (e.g., human sexuality, dating), outdated information, and perceived ableist or sexist language. Table 4 provides examples of comments for each type of classification.

Next, four team members incorporated the validators' recommendations into the modules. Modules with multiple "optional" ratings or any "not relevant" ratings also underwent extensive review and revision with additional input from experts when necessary. Our team also developed 12 new modules based on gaps in the content identified by the validators, resulting in a final count of 410 modules. The new modules included (a) five that introduce individualized education programs, O&M specialists, teachers of students with visual impairments (TSVI), the ECC, and low vision exams; (b) four on science, technology, engineering, and math (STEM)

topics at the elementary, secondary, and postsecondary levels; (c) two covering access technology, accessibility, and advocacy at the postsecondary level; and (d) one about employment discrimination.

At least one validator or another person with content expertise completed a second review of major revisions and additions. Five copy editors then revised the modules to improve understandability, reduce academic jargon, and format the content for web and mobile app readability. One copy editor created student versions of app content for student users from ages 16 to 24 years to encourage their participation, engagement, and responsibility in their preparation for the future. The copy editors had previous editing experience, and most had experience in the blindness field. They also attended a one-hour training session conducted by an expert in website text simplification that covered text simplification principles, suggestions for making information reader-friendly, and readability testing tools. Following copy editing, the development team did another review of the modules, which involved editing for consistency in terminology, proofreading, identifying technical terms for inclusion in a glossary, and checking and updating links to outside sources. A naïve reader then reviewed the edited modules and identified any remaining typos or issues with clarity, and those were corrected.

Aim 4: Integrating Final Content

Feedback from all phases of development depicted in Figure 1 and the finalized content culminated in the beta version of the *4to24* app. The app provides modules to the user account over time, about two per month on average. The account setup process includes a benchmarking feature that allows users to indicate the students' skills and experiences in various areas, which dictates the level of content they receive. Users have a list of modules displayed on their account dashboard, along with their activity and progress. Module reading and activities are self-paced,

and delivery of new modules is determined by a combination of student's age or grade level and user activity. New modules are accompanied by push notifications to the user's mobile phone to encourage engagement and interest in the information.

Discussion

This article covers the development of *4to24*, a comprehensive informational app that focuses on preparing students with visual impairments for future employment. Development of the app was a 5-year iterative process during which key stakeholders—parents of children with visual impairments, students with visual impairments, service providers, and content experts—provided input that guided the app's content and design. By providing relevant, timely information and resources directly to parents and students, the *4to24* app aims to facilitate parental involvement and support teenagers and older youth in increasing independence, gaining confidence, and taking an active role in their learning and skill development.

This app differs from other apps for students with visual impairments previously described in the literature in some important ways. Other apps developed for this population focus on skill development in a particular academic area: *Animal Watch*, an online math tutoring system (Beal et al., 2011; Beal & Rosenblum, 2015), and *iBraille Challenge*, a braille reading and literacy app (Kamei-Hannan et al., 2015, 2020). In contrast, the *4to24* app covers a wide range of topics intended to facilitate overall independence and preparation for employment. Additionally, the audience for *4to24* is primarily parents of students with visual impairments rather than students and their teachers. These differences in focus and audience resulted in several unique issues, particularly related to content development and validation.

After its initial creation by the writing team, the *4to24* app content underwent a rigorous validation process and multiple rounds of revision to ensure content accuracy and relevance.

Involving stakeholders in the content development and validation processes provided diverse perspectives and promoted relevance and comprehensiveness of the information for parents and students. Validators agreed on the relevance, age-appropriateness, and accuracy of most modules, but had divergent ratings in some areas, which may reflect philosophical differences and varying experiences. On occasion, several validators gave conflicting or even opposite advice regarding some topics, and these instances were adjudicated by the team when necessary. Ultimately, these differing perspectives strengthened the breadth and depth of the app content. Examples of improvements made to the content included a stronger emphasis on STEM topics and a wider variety of resources.

The iterative content development and validation processes led to the production of over 400 modules that address essential or important topics for students with visual impairments and their parents. The modules do not represent a curriculum and are not intended to replace services such as the individualized instruction that is provided by TSVIs, O&M specialists, and other service providers. The modules do provide information, activities, and resources to support students in their transition to postsecondary education and employment, beginning in preschool. They also promote development and reinforcement of concepts and skills outside of school hours through everyday activities and encourage collaboration and exchange of information between families and service providers. Considering the time constraints that service providers face when delivering ECC instruction during the school day (Lohmeier et al., 2009; Opie, 2018), helping families identify learning opportunities at home and in the community is vital.

Limitations

Several limitations are important to consider regarding this report. First, we had a relatively small number of content validators, although they represented multiple stakeholder groups.

Because some validators provided more extensive feedback than others, their perspectives may have had a larger influence on the final app content. Second, we relied on convenience samples of parents and students, which may limit the generalizability of the focus group results to the larger population of students with visual impairments and their families. Moreover, because the student focus groups centered on functionality rather than content, students provided limited input on the topics covered in the app. Finally, because this phase of the project was not a research study, it did not involve systematic collection of demographic information. Although we strived to include diverse perspectives and experience in our stakeholder groups, demographic information on stakeholders and end users is limited.

Implications and Future Directions

This app development project has several implications for developers who may plan similar projects. When developing resources for parents and families, we recommend starting small. This project required over 5 years of very labor- and time-intensive efforts to have all parts completed and compiled at the end. Producing content spanning so many topics and ages was a massive, and perhaps overly ambitious, undertaking. An app that covered fewer years or topics initially could have been produced faster and built upon in the future. Second, establish clear guidelines and targets from the beginning for measures such as amount of content, length of content, and reading level. Rounds of editing could then be better focused on an iterative process to improve content. For this project, establishing such guidelines helped with consistency across multiple writers, but the content still required more rounds of editing than anticipated. Additionally, because we set guidelines for minimum—but not maximum—amount and length of content, we produced a much larger volume of content than originally planned. Third, seeking input and feedback from target users and stakeholders is critical to ensure that information is

relevant and relates to the purpose of the resource. Likewise, have the resource validated by external experts to ensure it objectively meets the goals of the project. Fourth, establish mechanisms for keeping information up-to-date for time-sensitive resources. Examples from this app include periodic content reviews, a built-in link verification tool, and grant funding for future updates. Integrating new research findings, trends in the field, and updated website links will keep content current and relevant for users.

Conclusion

The *4to24* app provides a new resource that supports parents in their involvement with their children's growth and preparation for future employment. Service providers can inform parents and students about this tool to encourage parent engagement and student responsibility in building independence over time. The app's field test has been completed, and the app is now available on iOS and Android platforms, and on the web at 4to24.org. App content for parents of students who are deaf-blind and have additional disabilities will be available in a future release.

References

- Allman, C. B., & Lewis, S. (Eds.). (2014). *ECC essentials: Teaching the expanded core curriculum to students with visual impairments*. AFB Press.
- Beal, C. R., & Rosenblum, L. P. (2015). Development of a math-learning app for students with visual impairments. *Journal on Technology and Persons with Disabilities*, 3(22), 1–9.
- Beal, C. R., Rosenblum, L. P., & Smith, D. W. (2011). A pilot study of a self-voicing computer program for prealgebra math problems. *Journal of Visual Impairment & Blindness*, 105(3), 157–169. <https://doi.org/10.1177/0145482x1110500310>
- Cmar, J. L. (2015). Orientation and mobility skills and outcome expectations as predictors of employment for young adults with visual impairments. *Journal of Visual Impairment & Blindness*, 109(2), 95–106. <https://doi.org/10.1177/0145482x1510900205>
- Coffey, M., Coufopoulos, A., & Kinghorn, K. (2014). Barriers to employment for visually impaired women. *International Journal of Workplace Health Management*, 7(3), 171–185.
- Crudden, A., & McBroom, L. W. (1999). Barriers to employment: A survey of employed persons who are visually impaired. *Journal of Visual Impairment & Blindness*, 93(6), 341–350.
- Hatlen, P. (1996). The core curriculum for blind and visually impaired students, including those with additional disabilities. *RE:View*, 28(1), 25–32.
- Kamei-Hannan, C., McCarthy, T., D'Andrea, F. M., & Holbrook, M. C. (2020). Investigating the efficacy of Reading Adventure Time! for improving reading skills in children with visual impairments. *Journal of Visual Impairment & Blindness*, 114(2), 88–100. <https://doi.org/10.1177/0145482X20913128>
- Kamei-Hannan, C., McCarthy, T., & Pomeroy, B. (2015). Methods in creating the iBraille Challenge mobile app for braille users. *Journal on Technology and Persons with Disabilities*, 3,

130–144.

Kirchner, C., Johnson, G., & Harkins, D. (1997). Research to improve vocational rehabilitation: Employment barriers and strategies for clients who are blind or visually impaired. *Journal of Visual Impairment & Blindness*, *91*(4), 377–392.

Kraus, L., Lauer, E., Coleman, R., & Houtenville, A. (2018). *2017 Disability statistics annual report*. University of New Hampshire. www.iod.unh.edu

LeJeune, B. J., & Orr, A. L. (2011). *From school to college: A transition activity calendar for students who are blind or visually impaired (2nd. ed.)*. Rehabilitation Research and Training Center on Blindness and Low Vision. <https://www.ntac.blind.msstate.edu/consumers/tac/>

Lindsay, S., McDougall, C., Menna-Dack, D., Sanford, R., & Adams, T. (2015). An ecological approach to understanding barriers to employment for youth with disabilities compared to their typically developing peers: Views of youth, employers, and job counselors. *Disability and Rehabilitation*, *37*(8), 701–711. <https://doi.org/10.3109/09638288.2014.939775>

Lohmeier, K., Blankenship, K., & Hatlen, P. (2009). Expanded core curriculum: 12 years later. *Journal of Visual Impairment & Blindness*, *103*(2), 103–112.

<https://doi.org/https://doi.org/10.1177/0145482X0910300209>

Mazzotti, V. L., Rowe, D. A., Sinclair, J., Poppen, M., Woods, W. E., & Shearer, M. L. (2016). Predictors of post-school success: A systematic review of NLTS2 secondary analyses. *Career Development and Transition for Exceptional Individuals*, *39*(4), 196–215.

<https://doi.org/10.1177/2165143415588047>

McDonald, A., Haslam, C., Yates, P., Gurr, B., Leeder, G., & Sayers, A. (2011). Google calendar: A memory aid to compensate for prospective memory deficits following acquired brain injury. *Neuropsychological Rehabilitation*, *21*(6), 784–807.

<https://doi.org/http://dx.doi.org/10.1080/09602011.2011.598405>

McDonnall, M. C. (2010a). Factors predicting post-high school employment for young adults with visual impairments. *Rehabilitation Counseling Bulletin*, *54*(1), 36–45.

<https://doi.org/10.1177/0034355210373806>

McDonnall, M. C. (2010b). The employment and post-secondary educational status of transition-age youths with visual impairments. *Journal of Visual Impairment & Blindness*, *104*(5), 298–303.

McDonnall, M. C. (2011). Predictors of employment for youths with visual impairments: Findings from the Second National Longitudinal Transition Study. *Journal of Visual Impairment & Blindness*, *105*(8), 453–466. <https://doi.org/10.1177/0145482X1110500802>

McDonnall, M. C., & Crudden, A. (2009). Factors affecting the successful employment of transition-age youths with visual impairments. *Journal of Visual Impairment & Blindness*, *103*(6), 329–341. <https://doi.org/10.1177/0145482x0910300603>

McDonnall, M. C., Crudden, A., & Zhou, L. (2013). Employer attitudes towards persons who are blind or visually impaired: Perspectives and recommendations from vocational rehabilitation personnel. *Journal of Rehabilitation*, *79*(3), 17–24.

McDonnall, M. C., & Sui, Z. (2019). Employment and unemployment rates of people who are blind or visually impaired: Estimates from multiple sources. *Journal of Visual Impairment & Blindness*, *113*(6), 481–492. <https://doi.org/10.1177/0145482X19887620>

Munro, M. P., Garza, M. M., Hayes, J. R., & Watt, E. A. (2016). Parental perceptions of independence and efficacy of their children with visual impairments. *Journal of Human Services: Training, Research, and Practice*, *1*(1).

<http://scholarworks.sfasu.edu/jhstrp><http://scholarworks.sfasu.edu/jhstrp/vol1/iss1/3>

Nagle, K. M. (2001). Transition to employment and community life for youths with visual impairments: Current status and future directions. *Journal of Visual Impairment & Blindness*, 95(12), 725–738.

Newman, L., Wagner, M., Knokey, A.-M., Marder, C., Nagle, K., Shaver, D., Wei, X., Cameto, R., Contreras, E., Ferguson, K., Greene, S., & Swarting, M. (2011). *The post-high school outcomes of young adults with disabilities up to 8 years after high school: A report from the National Longitudinal Transition Study-2 (NLTS2) (NCSE 2011-3005)*. SRI International.

Opie, J. (2018). Educating students with vision impairment today: Consideration of the expanded core curriculum. *British Journal of Visual Impairment*, 36(1), 75–89.

<https://doi.org/10.1177/0264619617730861>

Protection of Human Subjects, 45 C.F.R. § 46 (2009).

<https://www.hhs.gov/ohrp/sites/default/files/ohrp/policy/ohrpreulations.pdf>

Riesen, T., Schultz, J., Morgan, R., & Kupferman, S. (2014). School-to-work barriers as identified by special educators, vocational rehabilitation counselors, and community rehabilitation professionals. *Journal of Rehabilitation*, 80(1), 33–44.

Sapp, W., & Hatlen, P. (2010). The expanded core curriculum: Where we have been, where we are going, and how we can get there. *Journal of Visual Impairment & Blindness*, 104(6), 338–348.

Test, D. W., Mazzotti, V. L., Mustian, A. L., Fowler, C. H., Kortering, L., & Kohler, P. (2009). Evidence-based secondary transition predictors for improving postschool outcomes for students with disabilities. *Career Development for Exceptional Individuals*, 32(3), 160–181.

<https://doi.org/10.1177/0885728809346960>

Wolffe, K. E. (2007). Transition: Planning for the world beyond school. In S. LaVenture (Ed.), A

parents' guide to special education for children with visual impairments (pp. 245–290). AFB Press.

Wolffe, K. E., & Kelly, S. M. (2011). Instruction in areas of the expanded core curriculum linked to transition outcomes for students with visual impairments. *Journal of Visual Impairment & Blindness*, *105*(6), 340–349. <https://doi.org/10.1177/0145482x1110500605>

Workforce Innovation and Opportunity Act of 2014, 34 C.F.R. § 361 (2016).

Zabelski, M. (2007). Start at the beginning: The importance of early intervention. In S. LaVenture (Ed.), *A parents' guide to special education for children with visual impairments* (pp. 37–58). AFB Press.

Zhou, L., Smith, D. W., Parker, A. T., & Griffin-Shirley, N. (2013). The relationship between perceived computer competence and the employment outcomes of transition-aged youths with visual impairments. *Journal of Visual Impairment & Blindness*, *107*(1), 43–53. <https://doi.org/10.1177/0145482x1310700104>

App development time line

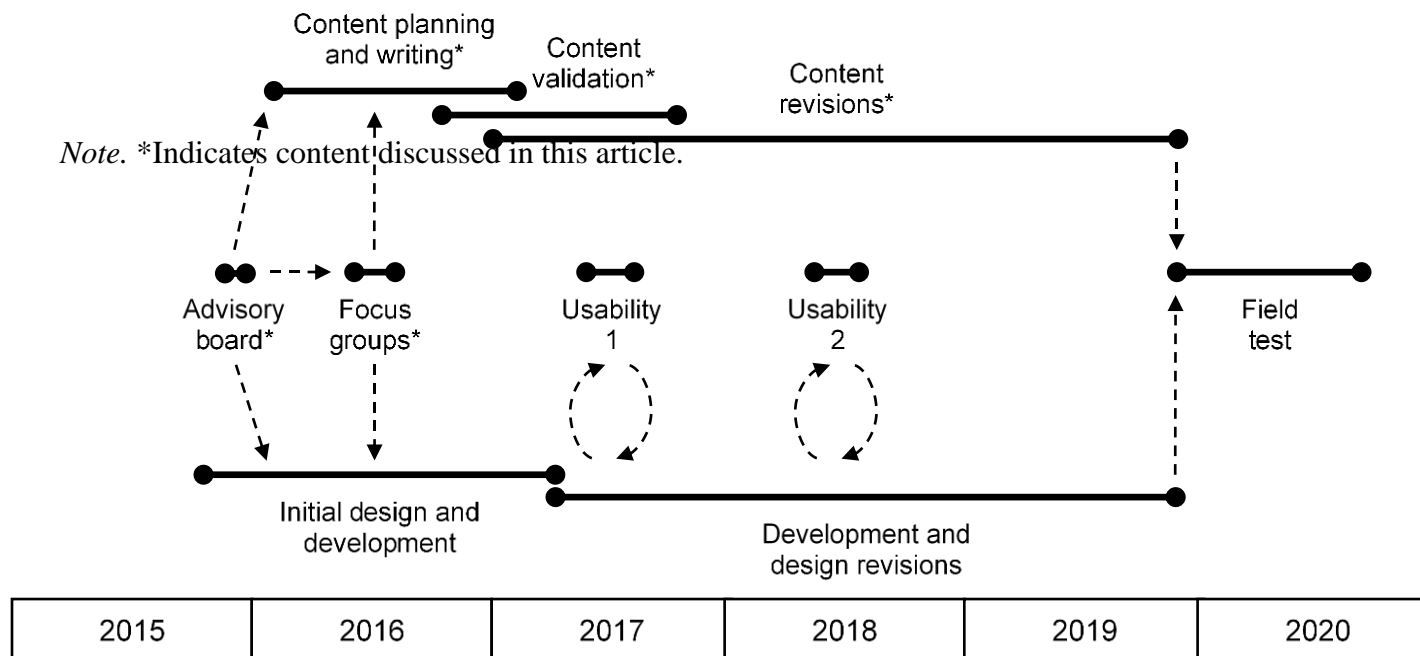


Table 1*Focus Group Questions for Youth with Visual Impairments and Parents*

Parents/Youth:

Where do you currently get information about transition planning for your child/for finishing your education and getting a job?

Prompt: Do you feel that you have enough information about transition?

What would make an app like this appealing to use?

What would deter you from using it/make you not want to use it?

What is the maximum amount of time you would spend to set up a profile on an app like this?

Do you use any other app for calendar or reminder systems on your phone?

Prompts: If so, what is it? What do you like about it? Dislike?

At what age do young people/did you (or do other young people) start using their own smartphone?

What are your overall impressions of the plan for an app like this?

Prompts: Suggestions? Anything else to consider in developing this app that we haven't discussed?

How would you like to hear about the app when it becomes available?

Parents Only:

What areas of your child's development cause you the most concern?

What areas might cause issues with your child getting a job after finishing school?

Table 2*Overview of App Content Categories*

Category	Modules (<i>n</i>)	Description	Age group
Advance	64	Preparing for and completing postsecondary education, including exploring college options, completing college applications, preparing for each semester, and campus and community involvement	High school to postsecondary
Connect	45	Use of technology, including computers, mobile devices, typing, and access technology skills	Preschool to high school
Earn	11	Starting a post-school career, including organization, social skills, and self-presentation at work; job retention and career advancement	Early career
Engage	46	Interacting with others, including communication skills, making friends, using social media, and participating in school and community activities	Preschool to high school
Explore	28	Home and community travel, including using the long cane, crossing streets, and navigating indoor and outdoor environments such as playgrounds, restaurants, and stores	Preschool to high school
Grow	53	Other topics, including self-esteem, self-determination, self-advocacy, puberty, dating, transition planning, vocational rehabilitation services, and voting	Preschool to early career
Learn	36	Accessing the core curriculum, including concept development, reading and writing, organization, and tactile graphics	Preschool to high school
Live	50	Independent living skills, including food preparation, home management, personal care, shopping, and money management	Preschool to high school
Ride	23	Using transportation, including exploring options, planning public transit trips, and following pedestrian and traffic safety rules	Preschool to high school
Work	42	Preparing for a future career, including career awareness, career exploration, chores, job-seeking skills, volunteering, and work experience	Preschool to high school

Table 3*Frequencies and Percentages for Quantitative App Content Validation Ratings*

Category	Ratings (n)	Relevant ^a				Age-appropriate	Accurate
		Essential	Important	Optional	Not relevant		
Advance	320	261 (82%)	49 (15%)	10 (3%)	0 (0%)	312 (98%) ^b	297 (93%)
Connect	211	144 (68%)	47 (22%)	20 (9%)	0 (0%)	197 (94%) ^b	195 (93%) ^c
Earn	55	46 (85%) ^b	8 (15%) ^b	0 (0%)	0 (0%)	55 (100%)	53 (98%) ^b
Engage	216	158 (73%)	49 (23%)	7 (3%)	2 (1%)	213 (99%)	207 (97%) ^c
Explore	131	111 (85%)	16 (12%)	4 (3%)	0 (0%)	129 (98%)	115 (88%)
Grow	249	190 (76%)	36 (14%)	22 (9%)	1 (<1%)	233 (94%)	222 (90%) ^b
Learn	168	132 (79%)	28 (17%)	8 (5%)	0 (0%)	161 (96%) ^b	150 (90%) ^c
Live	233	149 (64%)	64 (27%)	17 (7%)	3 (1%)	207 (89%) ^b	218 (94%)
Ride	107	76 (71%)	21 (20%)	10 (9%)	0 (0%)	105 (98%)	96 (90%)
Work	197	146 (74%)	46 (23%)	4 (2%)	1 (1%)	180 (91%)	189 (96%)
Total	1886	1413 (75%)	364 (19%)	102 (5%)	7 (<1%)	1792 (95%)	1742 (93%)

^a Percentages may not equal 100% due to rounding. ^b Had one missing value. ^c Had two missing values.

Table 4*Examples of App Content Validators' Comments*

Classification	Category	Description	Comment
No action	Work	Agreement	The information hits all critical issues facing children who are blind or VI. (Validator 3)
No action	Connect	Explanation of rating	But essential for the totally blind or braille user. (Validator 1)
No action	Advance	General statement	All students should see this, not just visually impaired ones. (Validator 5)
Simple change	Ride	Minor editorial change	Airport security typically calls them "bins," not "buckets." (Validator 4)
Simple change	Live	Technical/academic language	Some of the content under "more information" seems academic and technical for parents. (Validator 4)
Simple change	Live	Activity suggestion	Explore grocery purchasing and delivery apps. (Validator 2)
Simple change	Explore	Resource suggestion	Hadley has an excellent lesson on dog guides. (Validator 1)
Review	Earn	Topic to emphasize	I think there needs to be a topic devoted to assistive technology equipment and training post-graduation. (Validator 4)
Review	Connect	Need for references	You need a reference for the statement in paragraph 4. (Validator 4)
Review	Grow	Age, family, culture concerns	Shaving not appropriate at this age for the majority of children; also cultural and social/family dynamics need to be considered (Validator 1)
Staff	Ride	Not age-appropriate	The parallel/perpendicular activity seems too abstract for this age, but I am not an expert in this—just my impression. (Validator 2)
Staff	Learn	Relevance concern	This is fine if the youth attended a public or private school, but when a school for the blind is being considered, this is totally irrelevant. (Validator 5)
Staff	Explore	Outdated information	Teens these days hang out a lot at coffee shops and such. The mall is less of a hot spot unless it is for shopping. You might want to broaden the scope. (Validator 4)
Staff	Grow	Sexist language	Many of the goals of this section are sexist. (Validator 4)