Volume 3; Number 1; 2017

Online Journal of Missouri Speech-Language-Hearing Association (OJMSHA)

2017

Annual Publication of the Missouri Speech-Language-Hearing Association

Scope of *OJMSHA*

The Online Journal of Missouri Speech-Language-Hearing Association is a peer-reviewed, interprofessional journal publishing articles that make clinical and research contributions to current practices in the fields of Speech-Language Pathology and Audiology. The journal is also intended to provide updates on various professional issues faced by our members while bringing them the latest and most significant findings in the field of communication disorders.

The journal welcomes academicians, clinicians, graduate and undergraduate students, and other allied health professionals who are interested or engaged in research in the field of communication disorders. The interested contributors are highly encouraged to submit their manuscripts/papers to msha@shomemsha.org. An inquiry regarding specific information about a submission may be emailed to Jayanti Ray (jray@semo.edu).

Upon acceptance of the manuscripts, a PDF version of the journal will be posted online during August or September. This publication is open to both members and nonmembers. Readers can freely access or cite the articles.

Table of Contents

Research

Editorial Board (Peer Reviewers)

Carol Koch, EdD, CCC-SLP, has been a practicing pediatric speech language pathologist for the past 28 years. She has also taught at the undergraduate and graduate levels for the past 11 years. Her areas of clinical expertise, teaching and research interests include early intervention, childhood apraxia of speech, autism spectrum disorders, early phonological acquisition, assessment and intervention of speech sound disorders, family and sibling experiences, and clinical education. Carol was a recent participant in the ASHA Leadership Development in Health Care Program. She currently has a publishing contract to write a textbook on the topic of speech sound disorders. Carol has also been serving on the Board of Directors for Children's TLC for the past 6 years.

Janet L. Gooch, Ph.D., CCC-SLP is Full Professor and Dean of the School of Health Sciences and Education at Truman State University and a certified and Missouri licensed speech-language pathologist with successful clinical, teaching and administrative experience. She obtained her Bachelor of Arts in Speech Pathology from the University of Kansas, Master of Arts in Speech Pathology from Kent State University, and her Ph.D. from Case Western Reserve University in Cleveland, Ohio. Dr. Gooch's academic and research interests lie in the areas of Child Phonology, early reading abilities, and cleft lip and palate.

Elaine Beussink conducts diagnostic/treatment services for individuals at *Southeast Missouri State University Autism Center.* Earning her Master's degree in Speech Language Pathology in 1989, Elaine holds her ASHA Certificate of Clinical Competence and is a Licensed Speech Language Pathologist in the state of Missouri. She has been working with individuals with developmental delays across settings since 1989, specializing in autism spectrum disorders since 2002. Elaine has served the southeast region as Adjunct Faculty (SEMO), an In-District Autism Consultant and a Social Cognition therapist. She directs Camp SOCIAL, provides professional development for area service providers and presents at State and National conferences.

Kevin Squibb, PhD, CCC-A is an associate professor in the Department of Communication Disorders at Southeast Missouri State University. He holds a Master of Science in Audiology from East Tennessee State University and a Doctor of Philosophy degree from Bowling Green State University. He is a clinical audiologist with primary interest in speech science and diagnostic audiology with a focused interest in auditory processing. Dr. Squibb has been teaching at Southeast for 27 years and maintains an intense interest in his students and the pedagogy of teaching.

Martha J. Cook, PhD, CCC-SLP is an assistant professor in the Department of Communication Disorders at Southeast Missouri State University. She is a graduate of the University of Mississippi, Southeast Missouri State University and Southern Illinois University-Carbondale, where she earned her doctorate in Rehabilitation with an emphasis in Communication Disorders and Sciences. Her areas of interest in research and teaching are in fluency disorders (stuttering) and professional issues and pedagogy in communication disorders. Dr. Cook is the Coordinator of the Center for Speech and Hearing and the co-advisor for the Southeast Chapter of the National Student Speech-Language-Hearing Association.

Jennifer Kerr is a clinical assistant professor at Missouri State University (MSU). She has over 16 years of clinical experience working with adult populations as a medical speech-language pathologist (SLP) and 7.5 years of teaching and supervisory experience at the university level. Her primary clinical interest areas are aphasia, motor speech disorders, cognitive-linguistic communication, and working with caregivers. Jennifer has given professional presentations regarding aphasia treatment, counseling, supervision, and how evaluation and treatment of communication disorders should be integrated into the WHO model of service delivery. Her primary focus as an educator includes teaching undergraduate communication sciences and disorders majors and mentoring and supervising SLP graduate students. Prior to joining the faculty at MSU, Jennifer was a clinical instructor at the University of Washington, which is where she also earned her master of science in speech-language pathology. She also holds a bachelor of science in communication studies from the Florida State University.

Shirley A. (Blanchard) Brummett is a speech/language pathologist and Secondary SLP Coordinator for Raytown Quality Schools. Mrs. Brummett is a Southeast Missouri State University alumnus where she obtained her Bachelor of Arts and Master of Science degrees in Speech Pathology. Additionally, she holds a Master of Science in Special Education from the University of Kansas where she specialized in autism. Mrs. Brummett's professional areas of interest include phonological and sound system disorders, child language development and disorders and multicultural issues. When not engaged in professional pursuits, she enjoys hiking, cycling and kayaking with her husband, children, extended family and friends.

Lisa Bell, M.A., CCC-SLP, is a clinical assistant professor in the CSD department at MSU. She has over 27 years of clinical and instructional experience as a public school therapist, per diem clinician in a multitude of medical settings, and as a member of the graduate faculty at MSU. Lisa provides clinical instruction to graduate student clinicians and teaches the undergraduate "Observation II" course and a workshop for SLP Assistants.

Susan Fulton, Ph.D. CCC-A is an assistant professor in the Department of Communication Disorders at Southeast Missouri State University. She holds a Master of Science degree in Communicology (Audiology) from the University of South Florida, Tampa, FL and a Doctor of Philosophy degree in Communication Sciences and Disorders with a concentration in Hearing Science from the University of South Florida, Tampa, FL.

Dr. Fulton has worked clinically as a pediatric audiologist for 31 years and in academia for 13 years. She primary interests are auditory processing, psychoacoustics, and neural processes. Her current research focuses on the benefit of music training on auditory processing.

Shatonda Jones, PhD, CCC-SLP is an Assistant Professor of Communication Sciences and Disorders at Rockhurst University. She has worked in adult neurogenic rehabilitation for 10 years. Dr. Jones received her Bachelor of Science in Speech Language Pathology and Audiology from the University of Tulsa, Master of Arts in Speech Language Pathology from the University of Iowa, and Doctor of Philosophy in Therapeutic Sciences from the University of Kansas Medical Center.

Anne Bedwinek, PhD, CCC-SLP has alternated between full-time university teaching and medical speech pathology. She is an Adjunct Associate Professor at the University of Missouri and taught at Washington University, St. Louis University, and the University of Tennessee. She has served on four cleft palate-craniofacial teams, including St. Louis Children's Hospital and Mercy Children's Hospital. She is an active member of ASHA's SIG 5, the American Cleft Palate-Craniofacial Association, and the advisory board of RSF-Earthspeak. She holds a BA from the University of Michigan-Ann Arbor, and MA from Northwestern University, and a PhD from Union University.

Hortencia Kayser is a graduate of the University of Arizona and received her doctorate from New Mexico State University. Dr. Kayser completed a post-doctoral fellowship with the University of Arizona's National Center for Neurogenic Communication Disorders where she studied acquired language disorders in children. She has published in the areas of assessment and treatment of Hispanic children with communication disorders and has written 3 books on these topics. Her specialization has been the preschool Hispanic child who is learning English. She has served at Texas Christian University, New Mexico State University (NMSU), and Saint Louis University (SLU). Dr. Kayser was a full professor at NMSU and SLU. She is a Fellow of ASHA and received the Award for Special Contributions for Multicultural Populations.

Victoria Carlson-Casaregola, MA, CCC-SLP, is a school-based Speech-Language Pathologist and university adjunct instructor of advanced writing in St. Louis. She holds a Master's degree in English/ Expository Writing from The University of Iowa and a Master of Arts in Communication Sciences and Disorders from Saint Louis University. In collaboration with SLP colleagues at St. Joseph Institute for the Deaf, she co-wrote *GOALS: A Listening and Spoken Language Guide*. She won First Place in the ASHA 2006 Student Ethics Essay competition.

Grace McConnell, PhD, CCC-SLP, is an assistant professor at Rockhurst University. She received both her PhD in Communication Sciences and Disorders from Kansas University. After receiving her M.A. in CSD from KU, she worked as a clinician in the schools for a decade before returning for doctoral studies. Her interests include language development, language disorders of school age children, and multicultural issues in CSD, including the effects of poverty on language development.

Coordinator/Editorial Board

Jayanti Ray, PhD, CCC-SLP is a professor in the Department of Communication Disorders at Southeast Missouri State University. She teaches undergraduate and graduate courses, and her research interests are dysarthria, AAC, and quality of life in older adults. *OJMSHA* is her dream come true!

Production/Editorial Associate

Melissa Klaybor is a clinical fellow speech-language pathologist at ABC Pediatric Therapy in O'Fallon, Illinois. Melissa obtained her Bachelor of Science and Master of Arts degrees from Southeast Missouri State University. Some of her interests include the remediation of child and adult language disorders and quality of life in children and adults with communication disorders.

Effective Teaming in AAC: A Qualitative Case Study

Pamela Hart, Ph.D., CCC-SLP
Rockhurst University

Julie Scherz, Ph.D., CCC-SLP
Wichita State University

The purpose of this research was to explore factors that contributed to challenges experienced by an AAC team working to implement an AAC device for a child with Down syndrome. Data methods in this study included ethnographic interviews with team members, observations of the child in multiple environments, and review of relevant educational documents. Following the AAC evaluation, team members believed they had chosen a communication device that would allow the child to become an effective communicator. After three months of working to integrate the AAC device into the child's daily school routine, however, the child was displaying avoidance behaviors toward the AAC device. Four themes were identified that described the team's challenges (a) team member roles and responsibilities, (b) team member relationships, (c) Jason's frustrations with AAC, and (d) team member perseverance. An important implication of this study was the finding that through participation in the study, specifically the ethnographic interviews, team members reached a deeper level of reflection regarding how their own perceptions, values, and beliefs influenced the outcome. As they reflected on these challenges, team members were ultimately able to develop a more cohesive and collaborative plan to support the child's continued development in using the AAC device.

Key Words: AAC; Case Study; Qualitative; Team; Outcomes

Individuals with complex communication needs (CCNs) may require assistive technology including augmentative and alternative communication (AAC) strategies to become effective communicators. AAC is defined as an area of multidisciplinary research and practice that involves finding ways to compensate for severe difficulties with spoken and/or written modes of communication (American Speech-Language-Hearing Association, 2005). Etiologies of CCNs include clients with myriad of developmental or acquired disorders such as autism spectrum disorder, cerebral vascular accidents, Down syndrome, cerebral palsy, traumatic brain injury, and neurodegenerative diseases to name a few (Beukelman & Mirenda, 2013). In addition to the spoken language difficulties of these individuals, physical, linguistic, and/or cognitive limitations may co-occur. Due to these complexities, it is important to involve a variety of professionals in the AAC assessment and intervention process from disciplines such as special education, speech-language pathology, occupational therapy, physical therapy, and assistive technology. To be effective, these professionals must have two strong skill sets (a) knowledge of the intricacies of AAC assessment and intervention and (b) the ability to function as part of an effective interprofessional team. Both skill sets have been noted as equally important when working toward the goal of improving communication skills for individuals who use AAC (Hunt, Soto, Maier, Muller, & Goetz, 2002; Light & McNaughton, 2015; Soto, Muller, Hunt, & Goetz 2001; Stoner, Angell, & Bailey 2010).

Introduction

Teamwork and AAC

Building collaborative AAC teams is critical to achieving positive outcomes. While not a new concept, the idea of interprofessional education and collaboration has received strengthened attention in recent years (Fulmer, 2016; Zorek & Raehl, 2013). Professional organizations across healthcare and education have embraced the importance of interprofessional development of practitioners with knowledge that in most instances, education and healthcare professionals work as teams toward shared goals of improving client or student outcomes. Researchers have identified several factors supportive of effective interprofessional teamwork in healthcare and educational settings that include (a) a shared vision focused on the wellbeing of the client, (b) clear understanding of each team member's role, (c) trust and respect among team members, (d) strong interprofessional communication skills, (e) physical structure that supports collaboration, (f) a clear process to guide the work of the team, and (g) knowledge of one's own values, beliefs, and potential biases (Al-sayah et al., 2014; Baxter, Enderby, Evans, & Judge, 2012; Fulmer, 2016).

In addition to skilled professionals from a variety of disciplines, the client and his or her family, along with other key stakeholders should also be involved as equal team members in all aspects of the AAC assessment and intervention process. Families, however, have expressed feeling varying levels of value and involvement in healthcare and education teams, dependent on factors related to the culture of the team. In some instances, families and caregivers have deemed their input was not valued. Specifically, the structure of team meetings across (a) the amount of professional jargon used by team members and (b) the respect shown by team members toward each other has been found to determine whether families felt included as equal members of the team (Bailey, Stoner, Parette, & Angell, 2006; Briggs, 1997).

Specific to interprofessional AAC teams, Soto et al., (2001) examined perceptions of effective AAC teams in inclusive settings by conducting focus groups with five teams of professionals who had implemented AAC in inclusive settings for at least three years. A positive environment with recognition that successful AAC implementation is feasible and appropriate in inclusive settings was cited as an important shared goal of team members. Additionally, the ability to work cohesively and collaboratively, along with adequate training and knowledge of AAC strategies were also identified as important components. Similarly, Hunt et al., (2002) investigated the use of an AAC teaming process to promote the academic and social development of three students who used AAC. Collaborative support plans were developed for each student that specified the curricular, communication, and social supports necessary to enable the three students who used AAC to participate more fully in their educational programs. Team meetings were held each month to discuss progress and develop or refine specific responsibilities of team members. These regular team meetings in which team members were allowed to share expertise, goals, and determine responsibilities along with team member flexibility around professional boundaries were identified by the teams as important toward the development of a collaborative AAC intervention process. Knowledge of AAC strategies and devices along with strong team leadership were identified as particularly important to successful implementation of the AAC device. The importance of similar team dynamics were also identified by Stoner et al., (2010) who investigated implementation of AAC for a 16 year old with cerebral palsy. In this instance, the team was struggling to find ways to effectively implement the AAC device in inclusive settings. They noted lack of team leadership and unclear delineation of team roles negatively impacted the successful implementation of AAC for this student.

While there is general consensus among researchers and practitioners about the benefits of collaborative, interprofessional teams in AAC assessment and intervention, it continues to be the case that sometimes teams struggle to achieve a collaborative, effective AAC processes and as a result, achievement of positive outcomes for the client may suffer. The purpose of this the current study was to examine how the perceptions, beliefs, and values of an AAC team influenced the ability of the team to function in a collaborative, effective interprofessional manner. What happens when an AAC team is not able to achieve an effective outcome? How does such a team refocus and begin to build collaborative and respectful relationships with each other in a situation where tension and frustration are prevalent? This research study examines such a case. In this case, an AAC device was chosen and obtained for a child with Down syndrome. After three months of intervention, however, the child had not developed more effective communication skills than prior to the device, and in fact was developing avoidance behaviors toward the device. A variety of qualitative data collection methods allowed the researchers to analyze the factors that contributed to the challenges and how these were ultimately overcome. Interestingly, participation in this study was cited by the participants as a turning point for beginning to achieve more positive outcomes for the client. As will be demonstrated by this case, there exists a complex relationship between team culture and AAC outcomes.

Methodology

A qualitative, ethnomethodological case study design was chosen because the goal was to gain insight into the factors that impacted successful AAC intervention from the perspectives of the various team members. Case studies as explained by Stake (1995) include the study of a program, event, process, or an individual. In this study, the case was the AAC intervention process for a young child with Down syndrome. Ethical guidelines for human participants were followed. The researchers contacted the special education director of an area school district to inquire about the possibility of studying the AAC teaming process. The special education director referred the researchers to Jason's team and subsequent contacts were made to obtain informed consent from all participants. Jason is a pseudo name to protect the identity of the participants.

Participants

The participants in this study included Jason and his (a) mother, (b) speech-language pathologist (SLP), (c) special education teacher, (d) regular education teacher, (e) occupational therapist (OT), and (g) assistive technology consultant. All team members had been in their roles for at least 8 years and with the exception of the regular education teacher, had prior experience working with children who used AAC. Table 1 provides additional demographic information about the team members.

Table 1
Education Professional Team Demographics

Staff Member	Experience with AAC	Services Provided to Jason
SLP	14 years' experience as a SLP; Four previous clients with AAC needs;	First year providing services to Jason – provided 30 minutes of therapy in the special or regular education classroom, two times per week.
Special Education Teacher	10 years' experience as a special education teacher; Experienced with a variety of low-tech AAC strategies	Second year providing services to Jason – Jason spent approximately ¾ of each day in the special education room.
Occupational Therapist	8 years' experience as an occupational therapist; Previous experience with 12 clients with AAC needs	Second year providing services to Jason – provided 30 minutes of therapy to Jason, one time per week in the special education classroom.
Regular Education Teacher	12 years' experience as a classroom teacher; No previous experience with children who used AAC	First year working with Jason – Jason spent approximately ¼ of each day in the regular education classroom.
AT Specialist	18 years' experience with assistive technology; Previously worked with more than 50 individuals with AAC needs	First experience working with Jason – collaborated with the team as a consultant.

Jason. At the time of this study, Jason was 7 years old with a diagnosis of Down syndrome. He lived at home with both parents and a younger sibling. Jason attended his neighborhood school where he received a combination of self-contained and part time general education participation services. He was included in the regular first grade classroom for circle time, music, physical education, art, and some additional activities such as class parties. Within the self-contained classroom Jason received special education services for academics along with SLP and OT services. Jason's speech skills included the ability to vocalize some sounds but he was not yet able to produce intelligible words. Specific to language, Jason was able to follow one step directions, identify common objects in his environment by pointing, and express several communicative functions such as requests, questions, and protests through body language, gestures, and facial expressions. Jason had acquired the functional use of several signs and his team believed his potential for expressive language exceeded his ability to use sign language due to some fine motor difficulties. Jason's team also felt that sign language limited Jason to communication partners who also knew sign language and they wanted him to have a means to communicate with his peers and with unfamiliar individuals in the community. Jason also used a picture based communication book to request highly preferred items and activities. While Jason had been judged by the district educational psychologist to exhibit a moderate intellectual disability, his ability to use some signs and picture based communication showed good development of symbolic representation and potential for new learning. At the time of this study, Jason was in the emergent stage of literacy development, able to identify some of the letters of his name.

Jason had recently completed the school district's comprehensive re-evaluation process, and this had included evaluation for AAC needs. The current study was initiated approximately three months after Jason had received his new AAC device. The device chosen by the team was a static display device with 24 cells and multiple levels. The team's determination of this particular device had been made following a trial period with the device and two team meetings to discuss Jason's progress. When asked to participate in this study, all team members expressed realization of challenges that seemed to be impeding successful implementation of the AAC device. While not directly related to the goal of the study, all team members conveyed an eagerness to participate in the study with hopes of potentially determining a more successful future plan for implementation of AAC with Jason. This eagerness and dedication was evident in all interactions with the team members. The obvious commitment and perseverance of the team through challenging situations was clear and should be commended.

Data Collection

Data were collected over a 12-month period and included (a) ethnographic interviews with the SLP, special education teacher, regular education teacher, OT, assistive technology specialist, and Jason's mother (b) observations of Jason across home and educational settings, and (c) review of relevant educational documents including Jason's Individualized Education Plan (IEP) and the assistive technology AAC evaluation report written by the assistive technology specialist. The sequence of data collection consisted of (a) first conducting one ethnographic interview with each participant, (b) second, conducting one school and one home observation of Jason, (c) third, completion a second ethnographic interview with each participant, (d) fourth, conducting another school and home observation of Jason, (e) conducting three more school observations across a nine-week timespan, and (f) completing the third ethnographic interviews as needed. During observations, the researcher did not interact with team members nor Jason. Detailed field notes were taken for later analysis. Ethnographic interviews were conducted at locations convenient to the participants and included Jason's house and the elementary school. All participants completed at least two ethnographic interviews each lasting approximately 60-min each. If after the second interview, questions remained about the experiences, perceptions, or beliefs of the participant, a third interview was conducted. Jason's mother, assistive technology specialist, and SLP all completed three ethnographic interviews. The interviews were audiotaped and later transcribed verbatim. Documents were reviewed as they were made available to the researcher and occurred prior to the final ethnographic interviews.

Ethnographic Interviews. The ethnographic interviews were a key aspect of this project. Ethnographic interviewing involves asking open ended questions in an attempt to understand another's experiences from his or her own perspective. The goal is "to grasp the native's point of view" (Malinowski, 1922 p. 25). This method of inquiry originated in cultural anthropology. Participants in this study were asked open ended questions to encourage them to tell their own story. Spradley's (1979) recommendations for obtaining meaningful information were followed. According to Spradley, the most important initial step is "to get informants talking" (p. 46). Interviews were open ended to allow participants to direct the conversation to what they felt was most important and included both descriptive and structural questions. Descriptive questions prompted participants to describe their experiences and as recommended by Westby, Burda, and Mehta (2003), began with broad topics such as *Tell me about a typical day with Jason* followed by more specific descriptive questions such as, *You mentioned he doesn't like his AAC device. What would I see if I was to watch Jason try to use his AAC device?* Structural questions included asking the participant to reflect on the rationale for particular decisions along the way in addition to each participant's thoughts about what might have caused the AAC implementation challenges. In each instance, the participant's own words were used by the interviewer to provide reflection opportunities for the participant and to further develop the researchers' own understanding of the relationships between people and events. Summation comments on the part of the interviewer such as *That must have been so difficult* were avoided to decrease the likelihood of introducing ideas that would bias the participant to comment in a particular way. Instead, hearing the participant describe a difficult situation, the interviewer would be more likely to ask, *Can you give me another example of a difficult decision for the team?* In this way, the interviewer was able to better understand how the participant perceived various situations and events and was eventually able to identify repeated phrases and patterns as the individual discussed the events surrounding the AAC team, Jason, and the evaluation and intervention process. Additionally, Spradley's (1979) recommendations for rapport building were followed which included explaining the purpose of the interview, re-stating in the interviewee's own words, and asking meaning based questions rather than "why" questions. In this case, the interview process allowed the participants to reflect on their participation as a member of Jason's AAC team.

Triangulation

Reliability and validity of this qualitative study were partly established through a process of triangulation. Triangulation denotes the cross checking of information and conclusions through the use of multiple research procedures, methods, and sources. When the different procedures or sources are in agreement this is known as corroboration which increases the trustworthiness of the information (Hwa-Froelich & Westby, 2003). Trustworthiness of this case was facilitated by triangulating data sources, data methods, and data analysis. Data sources were triangulated by using multiple respondents in the interviews. Data methods were triangulated using interviews, observations across multiple environments, and review of educational documents. Triangulation of data analysis was accomplished by reviewing transcripts multiple times to identify themes and the use of the NVivo 10 (2012) qualitative coding software program to assist with the identification and organization of themes. Additionally, participant feedback was sought throughout the process to determine whether the story was being told in a way that was consistent with their experiences.

Data Analysis

Data were analyzed with an inductive approach to allow themes to emerge rather than trying to fit information into predetermined categories. Transcripts from the ethnographic interviews comprised the majority of the data used for this project. The information collected from observations and document review was used to triangulate findings and provide additional verification of identified themes. The data were reviewed multiple times by both researchers and codes generated to summarize the content. Through careful review, codes were collapsed into broad themes encompassing the main areas of difficulty encountered by the team. Additionally, participants were asked to review the codes and themes to make sure the information accurately reflected their thoughts and perceptions.

Ethnographic interviews. Ethnographic interviews were transcribed verbatim resulting in 163 pages of transcribed interviews. Principles of open thematic coding were followed in which line by line coding identified frequently occurring words and phrases for comparison at a semantic level across transcripts (Braun & Clark, 2006). To be considered a theme, the number of speakers who indicated the idea as well as the number of occurrences of the idea were taken into account. Qualitative coding software, QSR International NVivo 10 (2012) was used to assist with data reduction and identification of themes. For example, if an interviewee said, *The process of finding the AAC device was frustrating*, a code was created for AAC Frustrations and as additional interviewees discussed similar ideas, these utterances were also coded as AAC Frustrations. Once the initial coding was complete, the researchers reviewed the codes and synthesized these into themes that summarized similar ideas, thoughts, and perceptions of the participants.

Observations. Jason was observed seven times in a variety of contexts and activities for a total of 10 observation hrs. Five of the observations took place in the school setting and two were conducted at Jason's home. Field notes were taken to describe the activities, conversations, and contexts that occurred. In total, 56 pages of field notes were reviewed by the researchers multiple times and organized to reflect patterns of behavior on the part of Jason and his caregivers with regard to his communication skills and use of the AAC device.

Document Review. The assistive technology report and Jason's IEP were reviewed and information related to Jason's strengths, needs, and team recommendations was pulled from the documents for comparison to interview and observation data. Throughout the data analysis process, different methods were used to substantiate information obtained from the various sources. This systematic process of data analysis allowed the researchers to compare and contrast information across contexts, activities, and participants resulting in a rich description of the challenges encountered by the team.

Results

Identification of Themes

Once the initial coding was complete, the researchers reviewed the codes and synthesized these into four themes that encompassed similarities across ethnographic interviews, observations, and documents. The four themes were as follows (a) team member roles and responsibilities, (b) team member relationships, (c) Jason's frustrations with AAC, and (d) team member perseverance.

Team member roles and responsibilities. The IEP and assistive technology AAC report delineated some of the expected roles of team members. The IEP listed academic, communication, and physical developmental goals and specified the responsible professional for each area. The assistive technology AAC report included recommended tasks such as data collection by the SLP and special education teacher regarding Jason's use of the device across the school day. All team members agreed, however, that additional clarification of team member roles and responsibilities was needed once the AAC device was received. Specifically, team members did not indicate a clear understanding of (a) Who was the team leader? and (b) Who would develop the specific plans and strategies to integrate the device across Jason's day? Jason's mother expressed frustration the device was not consistently used at school and felt it was the responsibility of the SLP to keep her updated regarding Jason's use of the AAC device. The SLP, however, explained that she only worked with Jason two times a week for 30 minutes and assumed the special education teacher was updating the parent on a more regular basis. The special education teacher felt like she needed more training by the SLP because Jason was demonstrating avoidance behaviors when she attempted to have him use the device. Participants observed and commented about many instances indicative of insufficient role and responsibility clarification.

Our roles weren't clearly defined. I could have really used more input from the rest of the team for ways to coordinate use of the device across home and school but we have not met on a regular basis since the device was obtained. (Speech-Language Pathologist)

Additional role and responsibility clarification was also needed to determine who would maintain and program the device on a regular basis. The special education and regular education teachers felt it was the role of the parent to make sure the device was charged and ready at the start of each school day. Jason's mother, however, rarely used the device at home and assumed maintenance was taken care of at school.

> Nobody really said much right after the device was received. I assumed they were using it at school and all was going well. I didn't realize until a few months later that the device stayed in his locker most of the time. (Jason's mother)

After spending so much time working to provide Jason a device, I wish his mom would have charged the device at home and used it to reinforce what we were working on at school. It was confusing because she seemed determined to get this specific device but she didn't really stay as involved once we received it. (Special Education Teacher)

All of the professional team members expressed confusion regarding the role of Jason's mom with the AAC device once it was received because it did not seem to be used at home. Jason's mom explained during interviews, however, that she had many other ways to communicate with Jason at home that were more efficient than using the device. She believed it was the role of the professionals to determine ways to incorporate the device at school so that Jason would be able to use it when communicating with less familiar communication partners. The two home observations conducted for this project supported this finding. Jason was observed to mostly communicate using unaided gestures during these times at home. Gestures included putting his hand on his mouth to indicate he was hungry, animated facial expressions to indicate agreement or disagreement with choices offered, and pointing or pulling his mother toward preferred items or activities. During the first home observation, Jason used pointing to indicate he wanted to play a board game. During the game he interacted with his mother and sibling by using excited vocalizations that seemed to indicate he was having fun. Jason's mother and sibling understood all of his attempts to communicate without needing the AAC device. Additionally, Jason's mother said that she believed her role as Jason's mom was to educate others about children with special needs.

Team member relationships. While team members were cooperative with each other, they struggled to find ways to truly collaborate. Information gathered through the ethnographic interviews indicated some team members had difficulty trusting the motives of other team members. For example, before Jason entered kindergarten, Jason's mother had insisted that Jason be included in the regular education classroom to a greater extent than the school district professionals recommended. This conflict created a feeling of distrust that carried over into many of Jason's mother's interactions with school district personnel. She expressed during the ethnographic interviews that she was always worried the school district would try to do the least amount possible for Jason. Unknown to her but explained by the speech-language pathologist and occupational therapist during ethnographic interviews, however, the special education director had already told the school based team members that the district would buy whatever device the team recommended. Additional insights into team member relationships were conveyed by interview comments such as the following:

> I just kind of went along with what everybody else wanted because I didn't want to create conflict. I was mostly worried about the potential disruption of any AAC device on my classroom environment but did not feel like I could say that in our meetings. (Regular education teacher)
>
> There seemed to be a lot of tension between some team members and the parent. This made it difficult to openly discuss the child's strengths and needs because there was a fear of offending somebody. (Special education teacher)
>
> I might have come off a little too strong and made it difficult for some to express their opinions. I was just so worried they would brush off his needs and he wouldn't have a way to communicate. (Jason's mother)

Jason's frustrations with AAC. All team members expressed many positive aspects related to working with Jason. They explained he was usually a very happy child who enjoyed coming to school and liked most of the school day activities. All of the team members expressed enjoyment working with Jason and appreciation for the opportunity to know him. With regard to Jason's use of AAC, however, things became more challenging for the team members. All team members talked at length about Jason's frustrations with the AAC device and observations of Jason using the device supported these frustrations. During the first observation at Jason's school, Jason was observed in the special education classroom. He was working with his paraprofessional in a one-on-one activity that involved picture matching. He was not attending to the task and was playing with some dirt on the table and on the floor during the observation. At this point, the paraprofessional took Jason's AAC device out of his locker and placed it on the table, asking him, *Tell me what is wrong*? Jason immediately dove under the table and the paraprofessional looked at the researcher and said, *That is what he usually does anymore when I get the device out. He either runs away or hides from it*. The session continued with Jason's paraprofessional trying to coax Jason out from under the table and Jason refusing until the special education teacher came over and physically assisted him. Jason continued to refuse to engage with the device by shaking his head 'no' repeatedly as the paraprofessional prompted him to *Tell me what is wrong?* and *What do you want?* Eventually Jason was receptive to some hand over hand assistance to guide his selection to the icon that represented *I'M DONE*. During another observation, when the special education teacher took the AAC device out of Jason's locker, Jason bolted out of the classroom and down the hall to avoid having to work with the device. The paraprofessional brought Jason back to the room and he sat at a table refusing to look at the device. Jason's mother preferred the device be used for

Jason to communicate his knowledge of classroom academic content while the SLP advocated for use of the device to help Jason interact socially with peers.

The device was initially programmed by his mom and contained things that did not motivate him to communicate. He didn't really care about telling me something was a triangle and so I had a hard time getting him interested in using the device and ultimately, he avoided it. We need to reprogram the device with more motivating messages, but we need to all sit down and discuss the need to change this first (Speech-language pathologist)

The classroom teacher and various paraprofessionals worked to encourage Jason to interact with the device, but he was never observed to use the device spontaneously. All team members noted it was challenging to integrate the device throughout Jason's day in meaningful and reinforcing ways.

I was really hoping he would be able to use the device to tell us some important things like when he needs to use the bathroom. (Special education teacher)

The teachers are hoping he can tell them when he needs to use the bathroom but there is so much that goes into his ability to do that. He would have to be able to anticipate needing to use the bathroom before it gets to a point where it is an immediate need and he just hasn't shown us he can do that yet. It isn't as easy as just giving him a button to push. (Occupational Therapist)

Team Member Perseverance. Of notable importance in this study, even though there were frustrations along the way, was the determination of the team to achieve a successful outcome. As such, perhaps the most interesting and important theme that emerged from the data collected for this study was the perseverance of team members to find better answers and better ways of using the device with Jason. As team members described their participation in the assessment and intervention process, including challenges, they began to describe additional insight gained relative to the perspective of each team member and how their own biases and fears may have affected the outcome.

I'm sure Jason's mom was scared he would not receive a device. We need to work harder to come together as a team and solve these problems. I know Jason has more potential than we are seeing now. (Special education teacher)

The school professionals explained the purpose of the assessment had been to "find a device" while Jason's mother explained the purpose was to "not let the school district brush off Jason's need for this device."

> It was such a stressful transition from the early education center to the regular school… It is hard for parents to get used to a whole new team of people to work with again. And, there is the general idea among parents that the school will try to spend as little money as possible, so you go into the situation already defensive. (Jason's mother)

Toward the end of each participant's series of ethnographic interviews, comments began to emerge that demonstrated a realization that the purpose of the evaluation *should* have been to enable Jason to become a more effective communicator.

We got off on the wrong foot with each other and Jason's mom. This is a good team though and now that we've had time to think and talk about what went wrong, I know we will be able to come up with a better plan and Jason will become a good communicator. (Occupational therapist)

Final observations in the school setting indicated that school professionals had developed a more specific plan of implementation with increased accountability of team members. This included improved methods of communication between team members and better strategies for increasing the appeal of the device for Jason. Specifically, the team initiated (a) monthly meetings to discuss Jason's progress toward goals and team member questions, (b) use of a notebook in the classroom for therapists and educators to write notes to each other regarding how implementation of the device was going, and (c) use of fun messages on the device to increase collaboration between home and school such as "Last night at home we…." and another for Jason's teacher, "Today at school we…" to encourage use of the device in both environments. While Jason had initially avoided using the device to express academic content earlier in the study, he was observed to respond favorably to these new phrases and proved to be very forgiving of his initial avoidance of AAC.

Discussion

In current study, a multidisciplinary team completed an AAC evaluation and chose an AAC device they thought would enable Jason to become a more effective communicator. When after three months the child had developed aversion behaviors toward the device, this research project was initiated. Consistent with the findings of previous researchers, areas identified as important to effective team functioning in this study included (a) clear delineation of roles and responsibilities, (b) a team culture of trust where all members are able to share information, and (c) knowledge of effective AAC implementation strategies (Bailey, Stoner, Parette, & Angell, 2006; Briggs, 1997; Soto et al., 2001; Stoner et al., 2010). Unique to the current study, however, was the finding that team perseverance and ability to refocus during a difficult situation, was largely achieved through the team's participation in this qualitative study. As such, this demonstration of the value of qualitative methodologies toward shaping and improving team performance is an interesting and important finding. As team members stepped back from their day to day roles and reflected on their perceptions, thoughts, and beliefs about Jason's AAC evaluation and intervention, they were able to identify solutions to problems that had hindered successful outcomes. The researchers of this study believe that the process of ethnographic interviewing in which open ended questions were asked and the participant's own words were restated to achieve deeper levels of reflection, was an important contribution to the eventual more successful outcome.

As demonstrated in this instance one of the benefits of qualitative research design is the opportunity for participants to reflect on their experiences and begin to solve their own problems. While unfortunate that issues related to roles, responsibilities and frustrations were not initially discussed openly in team meetings, it is reassuring to find the team was able to refocus around these issues and develop common threads of understanding. Particularly identified by participants as disruptive to the team process was Jason's mother's feeling that the district was trying to avoid paying for an AAC device. In comparison, school team members expressed the special education director had already approved funding for whatever device ended up being recommended by the team. It is reasonable is to assume that if this information been conveyed to Jason's mother, conflict and distrust might have been lessened or avoided.

Another important clinical implication of this study is the need to widely disseminate and share available resources for AAC device assessment and intervention so that teams have access to these tools. One such resource that would have been potentially helpful to team members in this instance is the Collaborative Teaming for Students Using

AAC in Inclusion, Roles and Responsibilities document. This checklist provides a framework for AAC teams to establish shared and individual professional responsibilities during AAC implementation across classroom integration, programming and vocabulary support, peer interaction facilitation, maintenance, and documentation (www.bridgeschool.org/transition/docs/collab_teaming.pdf).

Directions for Future Research

This was an in-depth case study of one team and one client. Additional studies on a larger scale are needed to identify differences in experiences across teams and the ways that team culture and knowledge affect outcomes along with strategies to overcome these difficulties. One limitation of this study was that data collection was initiated during the device implementation phase rather than during the evaluation phase. The participants provided their reflections and interpretations after the evaluation phase was completed. It would be useful for future researchers to study the AAC teaming process during the initial meetings and device trial period with a similar in depth qualitative methodology.

AAC is a challenging but rewarding area of research and professional practice. Research is needed that expands our current understanding of the components of successful AAC teaming strategies with clear recommendations for professionals. It is the belief of the researchers of the current study that all individuals working to become competent AAC communicators are on the learning curve somewhere but how quickly progress is experienced depends on multiple individual and team factors as demonstrated by this case. As practitioners of AAC research and clinical practice, we must continue to advocate for the necessary time, support, and professional training required for successful AAC assessment and intervention. As demonstrated by this case, time spent in developing collaborative, trusting relationships at the outset, may save a great deal of time later in the process.

References

Al-sayih, F., Szafran, O., Robertson, S., Bell, N., & Williams, B. (2014). Nursing perspectives on factors influencing interdisciplinary team work in Canadian primary care setting. *Journal of Clinical Nursing, 23*, 2968-2979.

American Speech-Language-Hearing Association. (2005). *Roles and responsibilities of speech-language pathologists with respect to augmentative and alternative communication: position statement* [Position Statement]. Available from www.asha.org/policy.

Bailey, R., Stoner, J., Parette, H., & Angell, M. (2006). AAC team perceptions: Augmentative and alternative communication device use. *Education and Training in Developmental Disabilities, 41*, 139-154.

Baxter, S., Enderby, P., Evans, P., & Judge, S. (2012). Barriers and facilitators to the use of high-technology augmentative and alternative communication devices: A systematic review and qualitative synthesis. *International Journal of Language and Communication Disorders, 47*, 115-129.

Beukelman, D., & Mirenda, P. (2013). *Augmentative and alternative communication: Management of severe communication disorders in children and adults.* Baltimore, MD: Paul H. Brookes Publishing Co.

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology.

Qualitative Research in Psychology, *3*, 77-101.

Briggs, M. (1997). *Building early intervention teams: Working together for children and families.* Gaithersburg, MD: Aspen.

Fulmer, T. (2016). Effective interdisciplinary teams: Do we really know how to build them? *Generations*, *40*, 64-70.

Hunt, P., Soto, G., Maier, J., Muller, E., and Goetz, L. (2002). Collaborative teaming to support students with augmentative and alternative communication needs in general education classrooms. *Augmentative and Alternative Communication*, *18*, 20-35.

Hunt-Berg, M. (2005). The bridge school: Educational inclusion outcomes over 15 years. *Augmentative and Alternative Communication*, *21*, 116-131.

Hwa-Froelich, D. A**.,** & Westby, C. E. (2003). A Vietnamese Interpreter's Story: A Case Study. *Communication Disorders Quarterly*, *24*, 86-98.

Light, J., & McNaughton, D. (2013). Putting people first: Re-thinking the role of technology in augmentative and alternative communication intervention. *Augmentative and Alternative Communication*, *29*, 299-309.

Light, J., & McNaughton, D. (2015). Designing AAC research and intervention to improve outcomes for individuals with complex communication needs. *Augmentative and Alternative Communication*, *31*, 85-96.

NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 10, 2012.

Soto, G., Müller, E., Hunt, P., & Goetz, L. (2001). Critical issues in the inclusion of students who use augmentative and alternative communication: An educational team perspective. *Augmentative and Alternative Communication*, *17*, 62-72.

Spradley, J. P. (1979). *The Ethnographic Interview*. New York: Holt, Rinehart & Winston.

Stake, R. E. (1995), *The Art of Case Study Research*. Thousand Oaks, CA: Sage Publications

Stoner, J., Angell, M., & Bailey, R. (2010). Implementing augmentative and alternative communication in inclusive educational settings: A case study. *Augmentative and Alternative Communication*, *26*, 122-135.

Westby, C., Burda, A., & Mehta, Z. (2003). Asking the right questions in the right ways, strategies for ethnographic interviewing. *The ASHA Leader*, *8*, 4-17.

Zorek, J., & Raehl C., (2013). Interprofessional education accreditation standards in the USA: A comparative analysis. *Journal of Interprofessional Care*, *27*, 123-130.

Contact:

Pam Hart, PhD, CCC-SLP
Rockhurst University
Communication Sciences and Disorders
Associate Professor
1100 Rockhurst Road
Kansas City, MO 64110
Phone: (816) 501-4223

Note: The authors do not have any financial or nonfinancial disclosures.

Auditory Benefits of Computer-based Music Training

Susan E. Fulton, Ph.D., CCC-A

Southeast Missouri State University

Amanda Peluso, BA

University of South Florida, Tampa

Jennifer L. O'Brien, Ph.D.

University of South Florida, St. Petersburg

Current research shows that musical training enhances neural and behavioral auditory skills, even in as little as 20 minutes to 5 weeks of instruction (Barrett, Ashley, Strait, & Kraus, 2013; Pantev & Herholz, 2011). A computer-based music training program may be an innovative tool for improving auditory perception and listening skills. The purpose of the current study was to examine the effects of a computer-based music training program on auditory processing abilities. Participants included 20 young adults with hearing within normal limits and no history of musical training, defined as private lessons or band/orchestra/chorus class for two years or more. Participants were randomized into either a training group or a no-train control group. The training group completed a computer-based music training program, Quaver's Marvelous World of Music™ (www.QuaverMusic.com), for 30 minutes, 6 days a week, for four weeks. Significant improvement in scores on the Dichotic Digits Free-Recall (triple-pair test) and Adaptive Test of Temporal Resolution (across-channel condition) were found for the training group. No improvement in scores on either test was found for the no-train control group. Results suggest benefits of music training on auditory skills.

Key Words: Auditory training; Music training; Auditory perception; Listening skills

Introduction

Central Auditory Processing Disorder, or (C)APD, is defined by the American Speech and Hearing Association (ASHA) as a deficit in the neural processing of auditory stimuli that is not due to higher-order language, cognitive, or related factors (ASHA, 2005). (C)APD is characterized by problems in one or more of the following skill areas: sound localization and lateralization, auditory pattern recognition, temporal processing, and poor auditory performance in difficult listening environments (ASHA, 2005). Individuals with (C)APD often struggle with tasks such as remembering the content of auditory instructions, processing the timing of auditory stimuli, discriminating auditory signals from competing signals, and understanding speech presented in noise or reverberant acoustic environments (American Academy of Audiology [AAA], 2010).

Programs for treatment following diagnosis of an auditory processing deficit are limited. Emanuel, Ficca, and Korczak (2011) surveyed 195 audiologists with expertise in (C)APD diagnosis and treatment. Environmental modifications (e.g., preferential seating, gaining attention, and repeating or rephrasing) were recommended most often, followed by remediation tools (e.g., computer training programs, auditory closure activities, and phoneme training), and finally compensatory strategies (e.g., active listening training, metamemory skill training, self-advocacy, organizational management, and context derived vocabulary building). Among remediation tools, auditory closure activities and the linguistically-based computer training program, Earobics®, were recommended 70% of the time. Additional remediation tools recommended by (C)APD professionals include phonemic training, temporal training, Fast ForWord® software, and prosody training. While many management styles are available, many are linguistically-based and address reading and phonetic skills. The selected therapeutic strategy should be based on the individual's unique profile of auditory processing strengths and weaknesses, which may involve non-linguistic listening skills such as prosody, temporal processing, and auditory memory.

The guidelines for (C)APD intervention (ASHA, 2005; AAA, 2010) recommend that interventions include both linguistic and non-linguistic activities. Linguistic activities include phoneme discrimination and processing target signals in noise, while non-linguistic activities include intensity, frequency, and duration discrimination, as well as temporal gap discrimination. Non-linguistic remediation activities such as temporal and prosodic training are not commonly recommended. Sharma, Purdy, and Kelly (2012) used a randomized trial control method to examine the effects of language-oriented, linguistic based training and non-linguistic based training. Those exposed to non-linguistic training showed improvement with frequency discrimination and temporal pattern perception, concepts and directions, recalling sentences, receptive language skills, and core language skills.

Currently, computer-based auditory training programs provide a viable intervention for auditory processing skills remediation. Commonly used computer-based training programs include Listening and Communication Enhancement (LACE; Sweetow & Sabes, 2006) and Brain HQ (Posit Science: www.BrainHQ.com). These linguistically-based programs use acoustic stimuli that range from phonemes and single words to sentences and small paragraphs, often presented in challenging listening situations. A need exists for non-linguistic-based programs, which may be useful treatments for individuals with auditory processing problems, in addition to, or in place of, commonly utilized linguistic-based training methods.

Successful auditory training programs must be intensive and graduated in difficulty, with time dedicated on a consistent basis over the course of several weeks at minimum (Weihing, Chermak, & Musiek, 2015). Compliance using and completing these programs varies from 30% (Sweetow & Sabes, 2010) to 84% (Chisolm et al., 2013). Low compliance may be due to loss of motivation (AAA, 2010). Other critical considerations include the success-to-failure ratio and opportunity for immediate reinforcement. Alternative non-linguistic activities are needed to enhance auditory function. One engaging non-traditional remediation activity that shows promise is music training.

Research indicates that musical training enhances auditory memory, auditory discrimination, speech understanding in noise, and pitch perception (Schon, Magne, & Besson, 2004; Strait, Parbery-Clark, Hittner, & Kraus, 2012). Barrett, Ashley, Strait, and Kraus (2013) suggested that musicians have more precise neural timing to speech in quiet and noise. More robust responses with increased wave component amplitudes are evident, when controlling for attention (Pantev & Herholz, 2011). Musicians have a larger corpus callosum structurally, reflecting more interhemispheric communication (Schlaug, Jäncke, Huang, Staiger, Steinmetz, 1995a). There is greater connectivity with the frontal and motor cortices, as well as training-related plasticity in the hippocampus, resulting in improved attention and memory (Pantev & Heholz, 2011). These enhancements may be due, in part, to the fact that music performance requires a combination of different sensory systems including auditory perception (hearing and accurately tuning one's instrument), visual perception (reading a score), and kinesthetic control (postural control and manual dexterity), which are integrated and coordinated at a high degree of synchrony and accuracy. In regard to prosody, musicians demonstrate more refined pitch processing (Magne, Schon, & Besson, 2006; Moreno & Bidelman, 2014). This is likely due to melody and speech sharing similar acoustic parameters, fundamental frequency/pitch contours, and spectral characteristics. Musicians, compared to non-musicians, also have improved rhythm and pattern detection as well as timbre specialization (Barrett, Ashley, Strait, & Kraus, 2013; Pantev & Herholz, 2011). Fortunately, musical auditory benefits are possible at any age. Enhanced processing following music training programs has been observed/reported in children (Moreno, 2011), young adults (Bidelman, Weiss, Moreno, & Alain, 2014; George & Coch, 2011) and older adults (O'Brien, Nikjeh, & Lister, 2015).

Most of the literature has focused on effects of long-term musicianship; however, short-term training benefits are also evident. Moreno et al. (2011) showed improvement in vocabulary and language abilities for participants following 20 days of music training. Electrophysiologic changes have been observed following as little as two weeks of intense musical training (Lappe, Herholz, Trainor, & Pantev, 2008). Bangert and Altenmuller (2003) found adaptation in the auditory and motor cortices of non-musicians after just 20 minutes of active music playing. Even passive exposure to music can activate attention and memory systems (Moreno et al., 2011).

Musical training enhances skills in many of the same areas of difficulty for those with auditory processing deficits. Given the importance of auditory decoding, prosody, and integration for the development and maintenance of language-related skills, musical training, even in the short term, may be beneficial. Musical training is readily available in schools and communities and may be an untapped, engaging, inexpensive resource to help develop auditory skills in listeners. Olakunbi, Bamiou, Steward, and Luxon (2010) suggested that musical skills may be reflective of auditory processing difficulties. Indeed, music training may be a powerful resource to help enhance auditory deficits. No studies have used a randomized control method to examine the benefit of online music training on auditory processing skills.

The auditory benefits of music training, even in the short-term, are well documented. Computer-based training programs have yielded significant outcomes. However, the effect of a computer-based music program on auditory processing has not been investigated. The purpose of the current study was to examine how short-term training on musical themes (including pitch recognition, rhythm, and tempo) affects performance on behavioral auditory tasks in a typical hearing population. The study hypothesized that participants who trained with the computer-based curriculum, Quaver's Marvelous World of Music™, would demonstrate significant improvements on behavioral auditory measures (e.g., dichotic listening, temporal processing) commonly used for diagnosis of auditory processing deficits.

Method

Participants

Twenty young adults between the ages of 19 and 30 years (*M* = 23.31, *SD* = 3.69) were recruited for the current study. Individuals with prior musical training, defined as private music lessons or formal band/orchestra/chorus class of 2 years or more, were excluded. Additionally, participants had no history of hearing loss, severe speech/language delays or neurological disorders.

All individuals were recruited from undergraduate classes at the University of South Florida (USF) Tampa and St. Petersburg campuses. During recruitment, participants were contacted by e-mail and phone, or through an online participant pool. All participants signed an informed consent in accordance with the University of South Florida Institutional Review Board.

Study Design

The study was conducted on USF Tampa and St. Petersburg, FL campuses. During the initial testing session, a hearing screening (15 dB at 250-8000 Hz bilaterally) and baseline behavioral and electrophysiological data was gathered for all participants. Half of the participants were assigned to the training group and completed a computer-based music program for the four weeks, while the remaining 10 participants were assigned control no-train group for the same duration. Measures were repeated at follow-up. Behavioral test measures included the Dichotic Digits Free Recall (Strouse & Wilson, 1999) and the Adaptive Tests of Temporal Resolution (ATTR; Lister, Roberts, Shackelford, & Rogers, 2006). Measures were selected based on AAA guidelines, significant findings from the literature, and pilot research conducted by the principal investigator.

The Dichotic Digits Free-Recall test (Strouse & Wilson, 1999) assesses a listener's ability to attend to different signals presented simultaneously to each ear. Testing was presented in a Whisper Room sound-attenuated booth at a comfortable listening level via an Interacoustics Equinox audiometer using ER-3A insert headphones. Two free-recall conditions were tested – double pair and triple pair digits. In the double pair condition, two single-syllable numbers are presented simultaneously to each ear, followed directly by a second pair. In the triple pair condition, a third pair is presented directly thereafter. The listener is asked to repeat, in any order, all four or six numbers heard after each trial. A set is scored as correct only when the listener can repeat every number correctly. Each list consists of 25 sets of numbers. The total score represents the percent correct repeated trials. Higher scores suggest better ability to process competing auditory input presented simultaneously to both ears.

The ATTR (Lister et al., 2006) assesses an individual's ability to resolve acoustic changes over time. It is a computer-based test that determines the smallest detectible silent interval between two sounds, or a gap detection threshold (GDT). Pairs of narrow bands of noise are presented monaurally at a comfortable listening level simultaneously with visual boxes or pictures appearing on a computer screen. Three sets of stimuli are presented consecutively. The first set of narrowband noises are separated by a silent interval of 1 ms and serves as the reference or standard. The following two sets each contain a gap of 1 ms or a gap that adaptively varies in size. The last two sets vary randomly in presentation order. The listener must select the box on the screen that represents the different set or the one containing the larger gap. There are two test conditions: Within-channel and cross-channel. For the within-channel condition, both stimuli are ¼ octave noise bursts, each with a 2000 Hz center frequency.

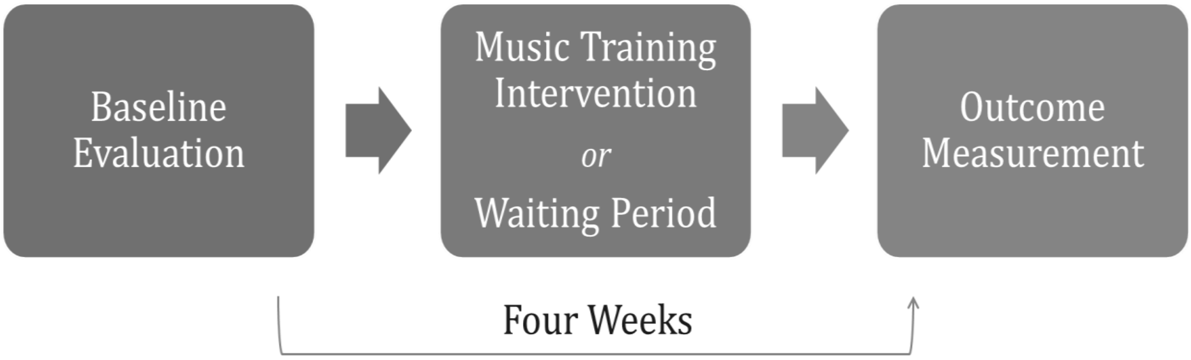

Figure 1. Example study timeline. Behavioral measures were completed for all participants at initial and final timepoints.

The across-channel is similar in presentation; however, the noise bursts have different center frequencies (2000 Hz before the gap and 1000 Hz following the gap). The test utilizes a standard adaptive two-alternative forced choice paradigm, where the duration of the silent gap between noise bursts is varied, increasing when the selected interval is incorrect and increasing in size when the selected interval is correct. The psychophysical procedure targets a 70.0% correct gap detection threshold.

Music Training

Participants were randomly assigned to a training group or a no-training control. The training group was given access to an interactive computer-based music program through Quaver's Marvelous World of Music™ (www.QuaverMusic.com). Quaver Music meets standards for music education through the National Association for Music Education as well as the National Coalition for Core Arts Standards. It has a customizable curriculum geared toward children in kindergarten through grade eight. The program consists of modules dedicated to music theory, composition, and music appreciation, as well as auditory skills training. Activities are highly interactive and adapt to users' skill level through scaffolding. With correct responses, tasks increase in difficulty and with incorrect responses, tasks are made easier. The program provides listeners with auditory training through use of musical games, videos, and creative activities. Participants in the training group were instructed to visit the website six days a week for four weeks. The principal investigator assigned specific at-home assignments, which lasted approximately 30 minutes each day – 15 minutes in listening activities and games and 15 minutes composition for keyboard, guitar, and percussion. Listening assignments included interval comparison, chord imitation, and pitch comparison exercises as well as instrument identification and rhythm, genre, timbre, and tempo training videos. Assignments were logged through QuaverMusic.com and monitored by the principal investigator to ensure all training was completed as instructed. The control group did not complete the training during the four-week wait period, but received the same pre- and post-testing.

Results

Behavioral test scores and average were determined for pre- and post-training sessions. All data was analyzed in IBM SPSS Statistics Version 24 (IBM, 2016). An alpha level of 0.05 was used. Behavioral test scores and average were determined for pre- and post-training sessions. All data was analyzed in IBM SPSS Statistics Version 24 (IBM, 2016). An alpha level of 0.05 was used.

Dichotic Digits

Pre-test Dichotic Digits (double-pair) test scores (No-train control *M* = 86.60, *SD* = 9.807; Train: *M* = 87.60, *SD* = 11.47) were analyzed using an independent *t*-test. Results revealed no significant difference between groups at baseline, indicating similar group performance before the intervention. Pre-test scores (above) and post-test scores (No-Train control *M* = 87.60, *SD* = 9.69; Train *M* = 94.00, *SD* = 6.39) were analyzed using a 2-factor repeated measures ANOVA with one within-subjects variable (time) and at one between-subjects variable (group). Results showed no significant effects of time or group or interaction between the two, indicating no music training effect.

Pre-test Dichotic Digits (triple-pair) test scores (No-train control *M* = 56.00, *SD* = 12.78, Train: *M* = 59.50, *SD* = 16.06) were also analyzed using an independent samples *t*-test. Again, results revealed no significant difference in pre-test scores. Pre-test scores (above) and post-test scores (No-train: *M* = 51.20, *SD* = 14.94, Train: *M* = 77.00, *SD* = 14.64) were analyzed using a 2-factor repeated measures ANOVA with one within-subjects variable (time) and one between-subjects variable (group). Results showed a significant effect of time [$F(1,18)=5.40$, $p=0.032$] and a significant interaction between testing time and group [$F(1,18)=19.07$, $p=0.001$]. Follow-up paired samples *t*-tests revealed that while the control group did not change between pre- and post- testing, the musically trained group improved significantly [$t(8)=4.41$, $p=0.002$], suggesting the intervention for the music group contributed to task performance (Fig. 2).

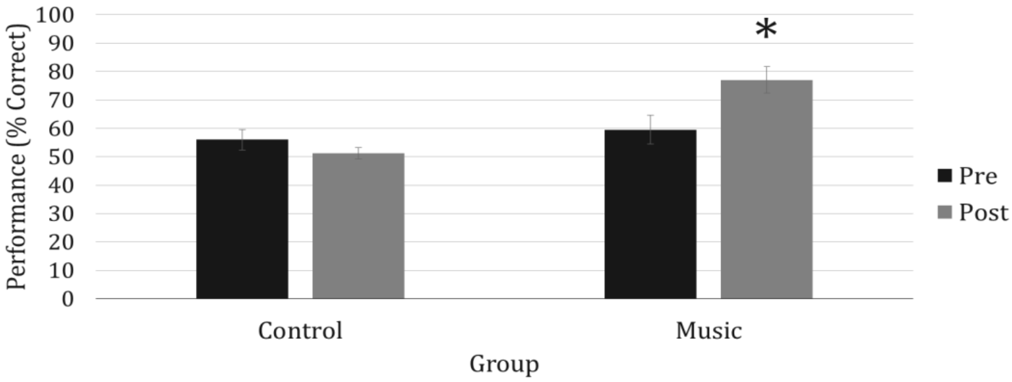

Figure 2. Results from the dichotic digits, triple pair task. Performance in percent correct is displayed as a function of group membership. Error bars denote standard errors of the mean. Asterisks denote significant improvement ($p<0.01$).

Table 1.
Pre-test ATTR scores for within- and across-channel conditions.

	Within-Channel		Across Channel	
Group	RE	LE	RE	LE
No-Train	5.7 ms (SD = 3.2)	5.8 ms (SD = 3.9)	32.2 ms (SD = 15.6)	31.0 ms (SD = 11.1)
Train	4.6 ms (SD = 1.9)	5.3 ms (SD = 4.0)	39.1 ms (SD = 17.9)	37.0 ms (SD = 13.6)

Table 2.
Post-test ATTR scores for within- and across-channel conditions.

	Within-Channel		Across Channel	
Group	RE	LE	RE	LE
No-Train	5.3 ms (SD = 3.0)	5.6 ms (SD = 5.1)	32.4 ms (SD = 17.0)	29.0 ms (SD = 11.2)
Train	3.5 ms (SD = 3.4)	3.5 ms (SD = 1.9)	30.5 ms (SD = 21.8)	27.8 ms (SD = 13.7)

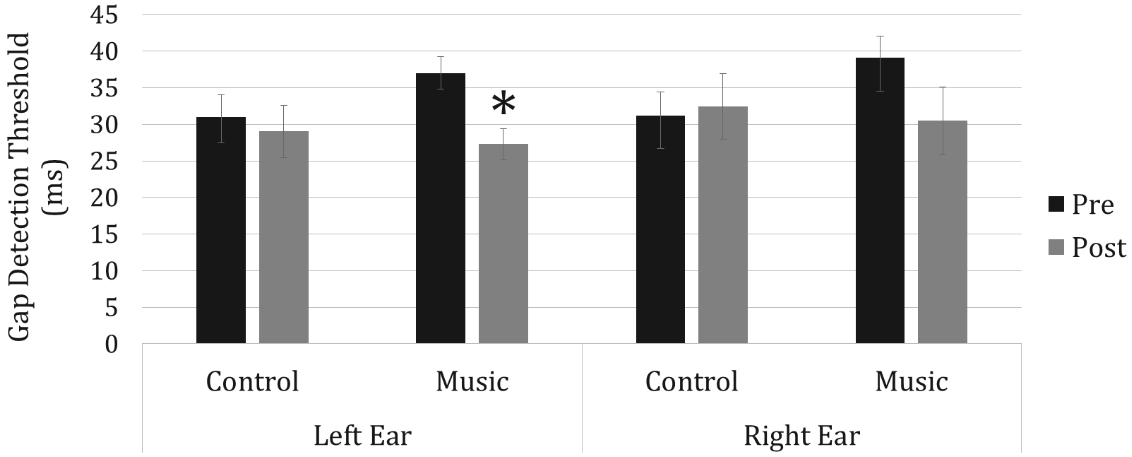

*Figure 3***.** Gap detection threshold (in milliseconds) for the across-channel condition of the ATTR. Separate ear data is displayed by group membership. Lower gap detection threshold scores indicate better performance. Error bars denote standard errors of the mean. Asterisks denote significant improvement (*p*<0.05).

Adaptive Test of Temporal Resolution (ATTR)

As a reminder, lower scores on the ATTR indicate smaller gap detection thresholds and overall better performance. In addition, gap detection thresholds are typically much smaller for within-channel conditions compared to across-channel conditions (Lister, Roberts, Krause, DeBiase, & Carlson, 2011). A Multivariate Analysis of Variance (MANOVA) was completed to assess pre-test scores for both within-channel and across-channel ATTR conditions. No significant results were found for either condition, indicating similar performance across and within groups (No-Train, Train) and across and within ears (RE, LE) before music training. See Table 1 for all pre-test scores.

A repeated measures MANOVA was completed for the within-channel condition scores (see Table 2), with one within-subjects variable (time) and two between-subjects variables (group and ear). No significant differences were found, indicating no music training effect pre- versus post-test for either group (No-train, Train) or ear (right, left). The same analysis was completed for the across-channel condition scores (see Table 2). The time by group interaction approached significance, $F(1,18)=4.05$, $p=0.059$, and a significant effect of time was found [$F(1,18)=4.76$, $p=0.043$]. Data were further analyzed, separating ears for comparison. Paired samples t-tests revealed only one statistically significant finding: A reduction in gap detection thresholds was observed for the left ear after the intervention, $t(8)=3.45$, $p=0.009$, but not for the right ear ($p=0.380$) (Figure 3).

Discussion

This study sought to bring together two lines of research: auditory processing interventions and the benefits of music training. It was hypothesized that typical-hearing listeners who complete a computer-based training on musical themes would perform better on auditory listening tasks typically used in diagnosis of (C)APD. Results suggest that a computer-based musical training program has the potential to improve auditory processing abilities, as evidenced by the significant findings for the triple-pair Dichotic Digits task and across-channel ATTR.

Although no training effect was observed for the Dichotic Digits double-pair task, performance at baseline approached ceiling levels and would not permit a significant change after the intervention. Baseline scores for the triple-pair test for both groups were worse overall when compared to the double-pair condition, indicating increased difficulty of the task. While the control and music groups did not statistically differ at baseline, recall performance increased for the train group after the computer-based musical training. This was statistically significant, indicating that the music training group had improved binaural integration abilities. As such, musical training impacted participant's performance and enhanced their ability to integrate and remember triple-pair digits.

Gap detection thresholds in the ATTR are typically smaller for within-channel than across-channel conditions and are often not well correlated (Lister et al., 2006). Data from this study are in agreement. It is suspected that the two gap detection conditions are processed by different channels (Lister et al., 2011). Although no significant results were observed for the within-channel condition pre-versus post-training, there was a statistically significant finding for the more difficult cross-channel condition. For the left ear, the musically-trained group showed a significant reduction in gap detection threshold size following intervention, suggesting that short-term online music training may improve temporal resolution.

The findings are promising in showing that music may be a valuable resource for improving specific auditory processing skills, however more research is needed. Many different Central Auditory Processing Disorder test batteries exist and are used to diagnose auditory processing abilities within the American Speech and Language Association's definition of (C)APD. The benefit of online music training for other common behavioral auditory processing measures needs to be examined. In addition, it would be valuable to use other test paradigms such as the complex Auditory Brainstem Response (c-ABR; Rocha-Muniz, Befi-Lopes, & Schochat, 2012; Skoe & Kraus, 2014; Tierney, Krizman, Skoe, Johnston, & Kraus, 2013), or mismatch negativity response (MMN; Moreno &

Bidelman, 2014; Putkinen, Tervaniemi, Saarikivi, Ojala, & Huotilainen, 2014) to determine if neural changes with an online music intervention are possible and repeatable. Quaver Music.com™ was designed for elementary and middle school-aged children, while the study sample was composed of college-aged students. Despite positive feedback regarding the music training program and subjective reports that the creatives/composition section was interactive and enjoyable, the intervention was likely too easy for the participants' age range. This study should be completed with younger participants to target the intended population of the Quaver Music curriculum. Also, training parameters could be redefined for better results. Future research could investigate the benefits of different session lengths and identify the ideal number of weeks and total number of hours trained. The current study design included 12 hours of training over the course of 4 weeks. Overall, the literature suggests that larger improvements occur when musical training takes place over a longer period (Bidelman et al., 2014). Inclusion of a subjective outcome measure may assist in tailoring the administration of training. Finally, future test sessions should employ experimenter blinding to group membership. This could reduce bias and prevent a possible Rosenthal Effect where the experimenter unintentionally influences results.

The literature has demonstrated that music training enhances skills in many of the same areas in which people with (C)APD struggle. Given the importance of auditory attention for the development and maintenance of language-related skills, musical training may aid in the prevention, habilitation, and remediation of individuals with a wide range of auditory processing deficits. However, further research is necessary to determine if a music intervention such as Quaver's Marvelous World of Music is effective in treating this population. Further research is needed to determine if an effective computer-based music training program can be recommended as a management strategy in the clinical setting for patients diagnosed with auditory processing difficulties.

References

American Academy of Audiology. (2010). Clinical practice guidelines for the diagnosis, treatment, and management of children and adults with central auditory processing disorder. Available from www.audiology.org/resources/documentlibrary/Pages/CentralAuditoryProcessingDisorder.aspx

American Speech-Language-Hearing Association. (2005). (Central) auditory processing disorders [technical report]. Available from www.asha.org/policy

Bangert, M. & Altenmuller, E.O. (2003). Mapping perception to action in piano practice: a longitudinal DC-EEG study. *BMC Neuroscience*, *4*(26), 1-14.

Barrett, K.C., Ashley, R., Strait,D.L., & Kraus, N. (2013). Art and science: How musical training shapes the brain. *Frontiers in Psychology*, *4*(713), 1-13.

Bellis, T. J. & Anzalone, A.M. (2008). Intervention approaches for individuals with (central) auditory processing disorders. *Contemporary Issues in Communication Sciences and Disorders*, *35*, 143-153.

Bellis, T.J. (2003) Assessment and management of Central Auditory Processing Disorders in the educational setting. *Science to Practice, 2nd Edition*. New York: Delmar Learning.

Bellis, T.J. (2002) When the brain can't hear: Unraveling the mystery of Auditory Processing Disorder. New York: Pocket Books.

Bidelman, G.M., Weiss, M.W., Moreno, S. & Alain, C. (2014). Coordinated plasticity in brainstem and auditory cortex contributes to enhanced categorical speech perception in musicians. *European Journal of Neuroscience*, *40*(4), 2662-2673. doi:10.1111/enj.12627

Brainhq.com/Retrieved December 25, 2017, from https://www.brainhq.com/

Chisolm, T. H., Saunders, G.H., Frederick, M.T., McArdle, R.A., Smith, S.L. & Wilson R.H. (2013) Learning to listen again: The role of compliance in auditory training for adults with hearing loss. *American Journal of Audiology, 22*(2), 339-342.

Earobics: Auditory development and phonics program [Computer software]. (1997). Cambridge, MA: Cognitive Concepts.

Emanuel, D.C., Ficca, K.N. & Korczak, P. (2011). Survey of the diagnosis and management of auditory processing disorder. *American Journal of Audiology, 20*(1):48-60. doi:10.1044/1059-0889

Fast ForWard: Reading and Language Intervention Program (2017). Oakland, CA: Scientific Learning Corporation.

George, E.M. & Koch, D. (2011). Music training and working memory: An ERP study. *Neuropsychologia, 49*(5). 1083-1094. doi:10.1016/j.neuropsychologia.2011.02.001

IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.

Katz, J. (1993). Central Auditory Processing: The Audiologic Contribution. *Seminars in Hearing, 14*(2), 191-199.

Lappe, C., Herholz, S.C., Trainor, L.J. & Pantev, C. (2008). Cortical plasticity induced by short-term unimodal and multimodal musical training. *Journal of Neuroscience. 28*(39): 9632-9639. doi:10.1523/JNEUROSCI.2254-08.2008

Lister, J.J, Roberts, R.A., Krause, J.C., DeBiase, D. & Carlson, H. (2011). An adaptive clinical test of temporal resolution: Within-channel and across-channel gap detection. *International Journal of Audiology, 50*(6): 375-384 doi: 10.3109/14992027.2010.551217

Lister, J.J., Roberts, R.A., Shackelford, J., Rogers, C.L. (2006). An adaptive clinical test of temporal resolution. *American Journal of Audiology, 15*(2), 133-140. doi:1059.0889/06/1502-0133

Magne, C., Schon, D., & Besson, M. (2006). Musician children detect pitch violations in both music and language better than nonmusician children: Behavioral and electrophysiological approaches. *Journal of Cognitive Neuroscience, 18*(2), 199-211.

Moreno, S. & Besson, M. (2006). Musical training and language-related brain electrical activity in children. *Psychophysiology, 43*(3), 287-291. doi:10.1111/j1469-8986.2006.00401

Moreno, S., Bialystok, E., Barac, R., Schellenberg, E.G., Cepeda, N.J., & Chau, T. (2011). Short-term music training enhances verbal intelligence and executive function. *Psychological Science, 22*(11), 1425-1433. doi:10.1177/0956797611416999

Moreno, S. & Bidelman, G.M. (2014). Examining neural plasticity and cognitive benefit through the unique lens of musical training. *Hearing Research, 308*(2014), 84-97. doi:10.1016/jheares.2013.09.012

O'Brien, J.L. Nikjeh, D.A. & Lister, J.J. (2015). Interaction of musicianship and aging: A comparison of cortical auditory evoked potentials. *Behavioural Neurology, 2015,* 1-12.

Olaknubi, D. Bamious, D.E., Steward, L. & Luxon, L.M. (2010). Evaluation of musical skills in children with a diagnosis of auditory processing disorder. *International Journal of Pediatric Otorhinolaryngology, 74*(6), 633-636. doi:10.1016/j.ijporl.2010.03.008

Pantev, C., & Herholz, S.C. (2011). Plasticity of the human auditory cortex related to musical training. *Neuroscience & Biobehavioral Reviews, 35*, 2140-2154. doi:10.1016/j.neubiorev.2011.06.010

Putkinen, V., Tervaniemi, M., Saarikivi, K., Ojala, P., & Huotilainen, M. (2014). Enhanced development of auditory change detection in musically trained school-aged children: A longitudinal event-related potential study. *Developmental science. 17*(2), 282-297

Quaver's Marvelous World of Music. Retrieved December 27, 2017, from http://www.quavermusic.com

Rocha-Muniz, C.N, Befi-Lopes, D.M., & Schochat E. (2012). Investigation of auditory processing disorder and language impairment using the speech-evoked auditory brainstem response. *Hearing Research. 294*, 143-152. doi:10.1016/jhears.2012.08.008

Schlaug, G., Jäncke, L., Huang, Y., Staiger, J.F., & Steinmetz, H. (1995a). Increased corpus callosum size in musicians. *Neuropsychologia 33*, 1047–1055

Schon, D., Magne, C., & Besson, M. (2004). The music of speech: Music training facilitates pitch processing in both music and language. *Psychophysiology, 41*, 341-349. doi:10.1111/1469-8986.00172.(Sharma, Purdy, & Kelly, 2012)

Sharma, M., Purdy, S. C., & Kelly, A. S. (2012). A randomized control trial of interventions in school-aged children with auditory processing disorders. *International Journal of Audiologyl, 51*(7), 506-518. doi:10.3109/14992027.2012.670272

Skoe, E. & Kraus, N. (2014). Musical training heightens auditory brainstem function during sensitive periods in development. *Frontiers in psychology*. *4*(622), 1-15. doi:10.3389/fpsyg.2013.00622

Strait, D.L. & Kraus, N. (2011). Can you hear me now? Musical training shapes functional brain networks for selective auditory attention and hearing speech in noise. *Frontiers in Psychology. 2*(113), 1-10. doi:10.3389/fpsyg.2011.00113

Strait, D.L. & Kraus, N. (2013). Biological impact of auditory expertise across the life span: Musicians as a model of auditory learning. *Hearing Research, 308*(2014), 109-121. doi:10.1016/j.heares.2013.08.004

Strait, D.L., Parbery-Clark, A., O'Connell, S., & Kraus, N. (2013). Biological impact of preschool music classes on processing speech in noise. *Developmental cognitive neuroscience 6*, 51-60. doi:10.1016/j.dcn.2013.06.003

Strouse, A., & Wilson, R. H. (1999). Recognition of one-, two-, and three-pair dichotic digits under free and directed recall. *Journal of the American Academy of Audiology, 10*(10), 557-571.

Sweetow, R.W. & Henderson Sabes, J. (2010). Auditory training and challenges associated with participation and compliance. *Journal of the American Academy of Audiology, 21*(9), 586-593. doi:10.3766/jaaa.21.9.4

Sweetow, R. W., & Sabes, J. H. (2006). The need for and development of an adaptive Listening and Communication Enhancement (LACE) Program. *Journal of the American Academy of Audiology, 17*, 538–558.

Tierney, A., Krizman, J., Skoe, E., Johnston, K., & Kraus, N. (2013). High school music classes enhance the neural processing of speech. *Frontiers in psychology, 4*(855), 1-7. doi:10.3389/fpsych.2013.00855

Weihing, J., Chermak, G.D., & Musiek, F.E. (2015). Auditory training for Central Auditory Processing Disorder. *Seminars in Hearing, 36*(04), 199-215. doi:10.1055/s-003501564458

Contact:

Susan Fulton, Ph.D., CCC-A
Southeast Missouri State University
1 University Plaza
Mailstop 2600
Cape Girardeau, Mo. 63701
sfulton@semo.edu

Disclosures: This article was based on an Audiology Doctoral Project by the second author in the Department of Communication Sciences and Disorders at the University of South Florida. Research was sponsored by a USF Internal Awards Program, New Research Grant. Quaver Music allowed full access to their educational website for training used in the study. None of the authors have intellectual or financial associations with Quaver Music.

Call for Papers: The Online Journal of Missouri Speech-Language-Hearing Association

Guidelines for Submissions to *Online Journal of Missouri Speech-Language-Hearing Association*

The *Online Journal of Missouri Speech-Language-Hearing Association* (OJMSHA) is MSHA's peer-reviewed journal, which is published annually. OJMSHA is not only available to MSHA members but is also accessible to readers out of state. Manuscripts from clinicians, students, and academicians are accepted on a rolling basis.

Manuscript submission

OJMSHA is an online journal that publishes papers pertaining to the processes and disorders of speech, language, and hearing, and to the diagnosis and treatment of such disorders, as well as articles on educational and professional issues in the discipline. Contributed manuscripts may take any of the following forms: reports of original research, including single-subject experiments; theoretical or review articles; tutorials; research notes; and letters to the editor. *OJMSHA* follows the policies and procedures of any typical scholarly publishing board. Articles submitted to *OJMSHA* are reviewed by professionals in communication science and disorders and, when appropriate, professionals from allied health fields are also invited to review the papers.

Manuscripts should be submitted to *OJMSHA* Coordinator, Jayanti Ray, at jray@semo.edu. Specific questions or concerns may also be directed to jray@semo.edu. Manuscripts are reviewed by at least two peer reviewers on the editorial board and final decisions are made jointly by the coordinator and peer reviewers. Submissions are reviewed and edited for content and clarity prior to publishing. The peer reviewers, based on their expertise, have the discretion to reject any submissions as necessary.

Circulation

OJMSHA is circulated to MSHA members using the website. The journal is also open to other nonmembers and other professionals.

Editing

The peer reviewers are expected to review the submitted paper and make specific recommendations to the author within 45 days from the initial date of submission of the manuscript. It is the author's responsibility to edit the paper for APA style (6th Edition), clarity, and consistency before submitting. After the paper is accepted, the authors are sent the article electronically for final proofreading. Only minimal alterations are permissible pertaining to the final draft.

The editorial consultants of *OJMSHA* are established authorities in their areas of expertise and most of them have terminal degrees in their disciplines.

Editorial Policies

All manuscripts are peer reviewed, typically by two editorial consultants with relevant expertise and the editor/coordinator. The principal criteria for acceptance are significance of the topic or experimental question, conformity to rigorous standards of evidence and scholarship, and clarity of writing. No manuscript that has been published or is under consideration elsewhere may be submitted.

All manuscripts should be accompanied by a cover letter requesting that the manuscript be considered for publication and stating that the manuscript has not been published previously and is not currently submitted elsewhere. The contact author's business address and phone number should be included. The names of any student authors who contributed to the article should also be included in the cover letter.

Letters to the Editor

E-mail letters to Jayanti Ray (jray@semo.edu). Please include your name and telephone number. Letters will not be printed without contact information.

Manuscript Style and Requirements

Contributions are expected to follow the style specified in the Publication Manual of the American Psychological Association (6th edition). To ensure clarity of scientific communication in this journal, articles should not exceed 50 manuscript pages (double-spaced, 12 font size, Times New Roman) including title page, abstract, references, tables, and figures. In light of special circumstances, the editorial board may approve articles longer than 50 pages. ASHA policy requires the use of nonsexist language. Authors are encouraged to refrain from using person-first language in preparing manuscripts.

A completely double-spaced electronic version of the manuscript should be attached to the author's cover letter and e-mailed to jray@semo.edu. A system of blind review is available to contributors. Authors who wish to remain anonymous to the editorial consultants during the review process should attach a second copy of the manuscript with no names or institutional references by which a reviewer could identify the author. Responsibility for removal of identifying information rests with the author.

Tables and Figures

Copies of tables and figures should be attached to each copy of the manuscript. Use Arabic numerals for both tables and figures, and do not use suffix letters for complex tables; instead, simplify complex tables by making two or more separate tables. MS Office tools may be used for figures and tables. Table titles and figure captions should be concise but explanatory. The reader should not have to refer to the text to decipher the information. The pictures (color or black/white) should be submitted using the jpeg format (resolution: 300x800 dpi). Keep in mind the width of a column or page when designing tables and figures.

Figures/charts and tables created in MS Word should be included in the main text rather than at the end of the document. Pictures may be submitted using separate files.

References

All literature, as well as test and assessment tools, must be listed in this section. References should be listed alphabetically, then chronologically under each author. Journal names should be spelled out and italicized. Pay particular attention to accuracy and APA style for references cited in the text and listed in the References. The reference page may be single-spaced.

Authorship

Papers should only be submitted for consideration once the authorization of all contributing authors has been gathered. Those submitting papers should carefully check that all those whose work contributed to the paper are acknowledged as contributing authors. The list of authors should include all those who can legitimately claim authorship. This is all those who have made a substantial contribution to the concept and design, acquisition of data or analysis and interpretation of data; drafted the article or revised it critically for important intellectual content. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

Research Ethics

All papers reporting human studies must include whether written consent was obtained from the local Institutional Review Board (IRB).

Patient/Participant consent

Authors are required to follow the IRB guidelines and the study participants have a right to privacy that should not be infringed without informed consent. Identifying information, including patients' names, initials, or hospital numbers, should not be published in written descriptions and photographs. Informed consent for this purpose requires that a patient/participant who is identifiable be shown the manuscript to be published. When informed consent has been obtained it should be indicated in the submitted article.

Copyright Transfer

The authors of manuscripts must transfer all rights, title, interest, and copyright ownership in *OJMSHA* when the MSHA accepts it for publication. The authors will not have the rights to edit, publish, reproduce, distribute copies, prepare derivative works, include in indexes or search databases in print, electronic, or other media. All accepted articles become the MSHA's property and may not be published elsewhere without the prior written permission. Authors may use parts of the article (e.g., tables, figures) in subsequent works (submitted to MSHA) without asking the permission. The Copyright Transfer form will have to be signed by the authors upon acceptance of the manuscript.

Copyright Clearance

ONLINE JOURNAL OF MISSOURI SPEECH-LANGUAGE-HEARING ASSOCIATION 2017, VOLUME 1, NUMBER 1

Research