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An Educational Audiology Model for Mississippi: Telepractice for Direct Service Provision

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AN EDUCATIONAL AUDIOLOGY MODEL FOR MISSISSIPPI: TELEPRACTICE FOR DIRECT SERVICE PROVISION

by
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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

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ABSTRACT
SALLY A. AUTRY: An Educational Audiology Model for Mississippi: Telepractice for Direct Service Provision
(Under the direction of Dr. Rebecca Lowe)

Hearing loss among school-aged children is becoming increasingly prevalent (CDC, 2019). Having hearing loss in a classroom setting can negatively affect a child's language development, academic achievement, and social communication. Educational audiology plays a vital role in the academic success of children with hearing loss by providing a full range of audiology services to students, as part of a multidisciplinary team, to facilitate listening, learning, and communication access. By performing specialized assessments, monitoring personal hearing instruments, recommending, fitting, and managing hearing assistive technology, providing support services, and advocating on behalf of students with hearing loss, educational audiologists help to bridge the academic gap between students with hearing loss and their peers. In Mississippi, however, educational audiology services are severely lacking, with only two known working educational audiologists in the state who cannot feasibly provide services to every child with hearing loss in Mississippi schools. To meet the increasing need, this pilot study establishes an educational audiology model in which both telehealth and direct educational audiology service provision are delivered to one school district within the state. As technology advances, audiologists have successfully delivered services to students remotely (Steuerwald et al., 2018, Lancaster et al., 2008, Govender & Mars, 2017), saving both parties time and resources while effectively providing necessary care to students with hearing loss. The author intends to identify a new model for educational audiology service provision which will work to serve a greater number of students with hearing loss in the state.

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LIST OF ABBREVIATIONS

CDC	CENTERS FOR DISEASE CONTROL AND PREVENTION
ASHA	AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION
EAA	EDUCATIONAL AUDIOLOGY ASSOCIATION
HA	HEARING AID(S)
UHL	UNILATERAL HEARING LOSS
OWLS	ORAL AND WRITTEN LANGUAGE SCALE
CELF	CLINICAL EVALUATION OF LANGUAGE FUNDAMENTALS
WASI	WECHSLER'S ABBREVIATED SCALES OF INTELLIGENCE
HAT	HEARING ASSISTANCE TECHNOLOGY
IDEA	INDIVIDUALS WITH DISABILITIES EDUCATION ACT
FM	FREQUENCY MODULATION
AAA	AMERICAN ACADEMY OF AUDIOLOGY
Db	DECIBELS
DS	DISTANCE SUPPORT
IRB	INSTITUTIONAL REVIEW BOARD
SLP	SPEECH-LANGUAGE PATHOLOGISTS
CI	COCHLEAR IMPLANT
IEP	INDIVIDUALIZED EDUCATION PROGRAM
HIPAA	HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT

CHAPTER I

INTRODUCTION

Throughout the United States, hearing loss among children has become increasingly prevalent. Between 2005 and 2016, the number of babies born in the U.S. who were identified with hearing loss grew from 855 to 6,337 (Centers for Disease Control and Prevention [CDC], 2019). Cases of hearing loss are prevalent among 14.9 percent of children ages six to 19 years (CDC, 2019). Per 1000 children ages three through 17, five will be identified as deaf or hard of hearing (CDC, 2019). In 2017, 54 babies born in Mississippi were identified with hearing loss (CDC, 2019). As these babies go throughout childhood, audiologists can develop the best method of treatment for each case to reduce the negative impact of hearing loss, leading to an improved quality of life (American Speech-Language-Hearing Association [ASHA], 2018). According to ASHA (ASHA, 2015), there are four major ways hearing loss impacts children: delays in the development of receptive and expressive language skills, deficits in language causing learning problems that result in reduced academic achievement, difficulties in communication that lead to poor self-esteem and social abilities, and influence on vocational choices. Services provided by an audiologist help to lessen the impact that hearing loss has on these areas for children. As children enter into educational settings, hearing loss can inhibit a student's ability to perform at the same academic level of their normally hearing classmates. Wake et al. (2004) found that students with hearing loss scored 10 months younger than the typical reading age of their peers, and language

and vocabulary skills worsened with greater degrees of hearing loss. The gap between normally hearing children and those with hearing loss grows over time (ASHA, 2020), with long term effects indicating consequences to educational outcomes and adult employment (Huttunen & Sorri, 2001). To minimize the negative effects on the development of cognition, psychological functioning, and verbal communication skills, early identification of hearing loss followed by a timely and effective intervention is necessary (Gopal, Hugo & Louw, 2001). Audiological services have now expanded to serve children and students specifically in educational settings.

Educational audiology is a specialized division of audiological studies developed to enhance listening and understanding of auditory information presented in the classroom (Educational Audiology Association [EAA], 2019). Educational audiologists provide a full range of audiology services to children in schools, as part of a multidisciplinary team, to facilitate student learning (EAA, 2019). In Mississippi, there is a severe lack in the provision of educational audiology services, with only two school districts employing audiologists in Mississippi, to the best of the researcher's knowledge. To combat inadequate access to healthcare services, telehealth is expanding as a promising solution for healthcare professionals to provide for the needs of their patients remotely. Ballachanda (2017) defines telehealth as the delivery of health-related services and information via telecommunications technologies. Teleaudiology utilizes telehealth to deliver audiology services, supporting remote and distance clinical hearing healthcare, professional and public education, public health matters, and health administration (Northern, 2017). With success observed in audiology service provision delivered via telehealth (Swanepoel, 2012; Hayes, 2012; Dennis, Gladden, Noe, 2012), audiologists

and researchers in Mississippi are considering the potential for telehealth to meet the audiology needs of students with hearing loss. The purpose of this study is to understand the efficacy of a hybrid model that combines on-site and telehealth methods to deliver educational audiology services to students with hearing loss in Mississippi schools.

CHAPTER II

LITERATURE REVIEW

Effects of Hearing Loss on Language, Education, and Social Development

Auditory information is constantly being obtained for processing as a child engages daily in active and passive listening. For a child to learn to effectively communicate orally, auditory information must be heard, correctly processed in the presence of background noise, and then applied with correct grammar and vocabulary to form a response (Smith et al., 2019). Hearing loss can impact any part of this process as a child learns to communicate. Children with hearing loss have trouble hearing quiet speech sounds, known as phonemes, such as the “s”, “sh”, “f”, “t”, and “k” sounds (ASHA, 2015). Without the ability to correctly hear all phonemes, a child’s auditory perception can be impacted, causing misunderstanding of verb tenses, subject-verb agreement, pluralization, and possessives, and overall language acquisition. Nott et al.'s (2009) study compared 24 children with profound hearing loss who received a hearing device between 13 to 30 months of age to 16 normally hearing children. The study found that children with normal hearing acquired words significantly earlier than those with hearing loss. Tomblin et al. (2015) compared the language outcomes of children with mild to severe hearing loss to normative data using a comprehensive battery of standardized language assessments and found that participants with hearing loss were at higher risk for delays in language development; specifically morphosyntactic abilities (forming language) were especially vulnerable. Without receiving services or benefits

from hearing aids (HA), students with mild bilateral loss demonstrated deficits in phonological memory and morphosyntactic skills, suggesting the detriment to structural aspects of language if hearing loss goes untreated (Dokovic et al., 2014). To summarize, Moeller and Tomblin (2015) stated that access to acoustic-phonetic properties is essential for spoken language development, and hearing loss can reduce both the amount learned and the rate of acquisition.

The impact of hearing loss extends beyond language acquisition as a child enters into an educational setting. Developmental gaps between normally hearing students and students with hearing loss may occur, putting those with hearing loss at risk academically. Fischer and Lieu (2014) compared 20 adolescents with unilateral hearing loss (UHL) to their normally hearing siblings using scores from the Oral and Written Language Scale (OWLS), the Clinical Evaluation of Language Fundamentals (CELF), and Wechsler's Abbreviated Scales of Intelligence (WASI) as outcome measures. They found that adolescents with UHL demonstrated worse overall expressive language scores, significantly lower Full scale, Verbal, and Performance IQ scores. Wake et al. (2004) collected standardized measures of language, cognition, articulation, reading, adaptive functioning, health-related quality of life, parental concerns of development, parent- and teacher-reported intelligibility and behavior, and teacher-reported school functioning outcomes of children with mild to profound hearing loss using a combined testing battery (CELF, PPVT, Goldman-Fristoe Test of Articulation, WISC) and a survey approach. Results indicated that on average, participants with hearing loss scored 10 months younger than the typical reading age of their peers, and language and vocabulary skills worsened with greater degrees of hearing loss. Every outcome measured, excluding

physical health, earned scores significantly lower than the typically developing population. Lower than average academic achievement is a common trend within other similar studies that measure students with hearing loss. Qi and Mitchell (2012) compared the academic performance students who are deaf or hard-of-hearing using a standardized achievement test to normative levels of academic performance. The results indicate significantly lower reading comprehension, language acquisition, and overall low academic achievement. Luei (2004) compiled a review of literature from 1966 to 2003 about the impacts of hearing loss on educational achievement and concluded that school-aged children with UHL have a 22-35 percent rate of repeating at least one grade. Depressed performance, which decreases the likelihood of acceptance into post-graduate secondary education programs (Garberoglio, Cawthon, & Bond, 2014), has been a common trend among deaf and hard-of-hearing populations (Wilbur & Quigley, 1975), Later in life, inhibited academic performance due to hearing loss can escalate to trouble with employment and socialization even after they are no longer in school (Moats, 2000).

Hearing loss additionally can influence children's socialization. According to Bain, Scott, and Steinburg (2004), a child who misses auditory information within conversations lacks the foundation of conventional social skills development. Socializing is not only critical to the foundation of language but is the basis for inclusion among peers. Constantinescu, Davis, Dornan, and Hogan (2015) examined the correlation between spoken language abilities and social inclusion of children with hearing loss. The researchers observed facets of each participant's education, social interaction, and social role fulfillment, and suggested that children with higher speech proficiency may be able to effectively communicate their needs verbally. They concluded that speech ability and

vocabulary skills do influence inclusion amongst their peers, as higher skills were likely to facilitate meaningful interactions with peers and provide more opportunities to be invited to social events. That being said, students with lower skills were less likely to have meaningful interactions (Constantinescu et al., 2015).

Role of Educational Audiologists

As indicated by the discussion of areas influenced by hearing loss, a student's primary need is intervention to improve linguistic skills, academic performance, and social interaction. As audiologists work primarily to diagnose, manage, and provide treatment for hearing and balance problems, educational audiologists specifically deliver a range of audiology services to children within educational settings (EAA, 2015). Educational audiologists contribute to a school multidisciplinary team to facilitate learning and communication for students with hearing loss or those with other disabilities. Educational audiologists use evidence from specialized hearing assessments to determine needed services and technology and counsel students throughout their education to promote self-advocacy of auditory needs, performance, and responsibility (EAA, 2019). Collaborating with private sector audiologists and other school professionals, educational audiologists help create an effective learning environment with ideal listening levels for students with hearing loss. Educational audiologists recognize the effects that hearing loss and auditory processing disorders can have on a child's communication, academic performance, and psycho-social development. Because of this, educational audiologists "collect and interpret data about the student's specific hearing loss and monitor the combined effects of hearing, listening, and or auditory deficits and classroom acoustics" (EAA, 2019). Education audiologists observe students' functional

ability to process auditory information in the classroom, link diagnostic information, assess program planning, and select educational accommodations to address these effects (EAA, 2019). They guide and manage these accommodations, including essential hearing assistance technology (HAT), to improve the student's access to auditory information. By educating students and school personnel about hearing impairments through consultation and collaboration, educational audiologists can support listening skills, auditory training, and language development.

The Individuals with Disabilities Education Act (IDEA) (2004) requires audiologists to addresses the services needed in these areas: screening, assessment, amplification, habilitation, counseling, and prevention, which includes assessing assistive technology and assistive technology services and routine checking of amplification devices and external components of surgically implanted medical devices worn by students with hearing loss. Students with hearing loss are therefore entitled to special accommodations and services that educational audiologists can provide. These services include conducting specialized hearing assessments, monitoring personal hearing instruments, recommending, fitting, and managing hearing assistance technology; providing and recommending support services and resources, and advocating on behalf of the students they serve (IDEA, 2004).

Hearing Assistance Technology

HAT continues to develop and improve listening experiences for people with hearing deficiencies. In fact, without HAT, a child with hearing loss is said to have less than 30 percent correct word recognition in the presence of noise in a classroom (Wolfe et al., 2016). Educational audiologists understand current hearing aid and cochlear

implant technology and how they best integrate with hearing assistance technologies. Appropriate selection and fitting of technology for students is necessary for effective amplification.

IDEA (2004) requires audiologists to determine the child's need for individual amplification, including selecting, fitting, and dispensing of appropriate technology, evaluating the effectiveness and validating the expected advantages of that technology. The EAA (2018) requires an audiologist to be involved in the implementation of auditory devices, such as a frequency modulation (FM) system. Since personal FM systems must be verified to ensure correct functioning and benefit to the user (Eiten & Lewis, 2008), the audiologist is the only professional who is qualified to fit and verify hearing aids and personal hearing assistance technology (EAA, 2019). Educational audiologists deliver training and support to students and school personnel on HAT use, limitations, and specific troubleshooting techniques. The student, the school personnel, and the teacher are required to receive training on function, proper use, and limitations of HAT instruments to ensure the child is receiving auditory input at an optimal level (American Academy of Audiology [AAA], 2011). IDEA (2004) additionally requires routine inspections of hearing aids and other external components of surgically implanted devices.

Classroom Acoustics

Educational audiologists specialize in the acoustical dynamics of classroom settings by understanding the effects of ambient noise on hearing and listening with appropriate modifications. As a member of the school multidisciplinary team, an educational audiologist provides the most knowledge about classroom acoustics and

appropriate listening levels specific to each student (EAA, 2018). Approximately 60 percent of instructional activities involve listening in a typical classroom (Stigler et al., 1999). Students with hearing loss need equal access to available auditory information to experience success where listening is the primary modality for learning (EAA, 2018). For a child with hearing loss to hear and understand spoken messages in a classroom, it is recommended that space's unoccupied noise level should not exceed 35 decibels (dB), with a signal-to-noise ratio of at least +15 dB for core learning spaces (AAA, 2011). Recent studies indicate, however, that an average classroom noise level during lessons is 72 dB (Kristiansen et al., 2014), suggesting that a teacher's voice be projected at over 85 dB. Many environmental factors can influence a classroom's ambient (background) noise levels, including the location, size, and shape of a classroom, its floor and ceiling materials, and the number of students. Reverberation within busy classrooms can influence the transmission of spoken messages, especially with distance between the speaker and listener. Educational audiologists most accurately determine classroom acoustic measurements (EAA, 2015), and by consistently accessing classroom acoustic information, provide strategies to decrease background noise which helps prevent the loss of information being taught (EAA, 2018). Individual classroom measurements and student assessment is necessary to identify the most effective accommodations for listening accuracy (Johnson, 2010). Before the implementation of HAT in a classroom, acoustic modifications should be made based on background noise and reverberation (ASHA, 2004). Additionally, a signal-to-noise ratio should be measured to ensure the appropriate selection and implementation of assistive listening technology systems (Crandell & Smaldino, 2000).

Dreossi et al. (2005) provide a summary of modifications in an overview of noise interference within a classroom environment. Enhancing basic adequacies of the space, such as adding absorbent material (carpets, rugs, rubber, etc,) to hard floor surfaces, hanging curtains on windows to minimize the impact of outside noise, monitoring equipment such as air condition units or ventilators that emit sounds, and placing tennis balls under the feet of desks to decrease noise when moving are options that decrease reverberation and improve classroom acoustics (Dreossi et al., 2005; Bistafa & Bradley, 2001; Bradley, 1986; Koszarny & Chyla, 2003).

In summary, perceiving spoken language by students with hearing loss is affected by background noise prevalent in classrooms. Several strategies can be implemented in classrooms to reduce the effects of background noise on auditory information transmission, including environmental, instructional, and/or communication accommodations, amplification options, and advocacy skills. A critical role of an educational audiologist is to assist teachers and other school personnel in implementing necessary strategies, creating an optimal listening environment for students with hearing loss.

Implementing Telehealth

Telehealth increases opportunities to provide healthcare services remotely. Four fundamental benefits of telehealth are improved access to patients, cost efficiency, improved quality of treatment, and meeting patient demands (Ballachanda, 2017). Teleaudiology allows providers to serve beyond their clinics or offices to patients located in urban or rural areas, saving time and resources by eliminating geographical barriers. Quality healthcare provided remotely can also allow better management of patients, and

increase overall patient satisfaction. A recent study with telemedicine indicated 38 percent fewer patients were admitted to care facilities, and patients were more engaged in their healthcare (Pande et al., 2015). Other benefits, including savings over inpatient care costs (Leff et al., 2009), support telehealth expansion. Feasible, low-cost videoconferencing provided a method of successful screening service delivery (Ciccia et al., 2011), making rural areas more accessible to professional care and lowering travel costs for patients. A study that explored patient preferences for direct-to-consumer telemedicine services found that patients prefer to use telehealth with their doctor whom they have an established relationship with. Results from a survey distributed to 4,345 respondents found that 52 percent of respondents were more willing to see their provider via telemedicine (Welch et al., 2017).

Telehealth has been useful in the delivery of audiological services. Lancaster, Krumm, and Ribera (2008) provide a successful model of telehealth within schools by administering hearing screenings remotely. Via interactive video and asynchronous technology, researchers performed otoscopy, tympanometry, and pure-tone audiometry and then compared the results to an on-site screening. The results indicated no significant difference between the outcomes of measures taken on-site versus those obtained via telehealth. Researchers concluded that telehealth technology is an adequate option for administering hearing screenings (Lancaster et al., 2008). Video otoscopy and online hearing testing in remote areas have been successfully implemented via telehealth services (Govender & Mars, 2017), allowing faster reception of treatment and its benefits. Govender and Mars (2017) compiled a scoping review of 23 peer-reviewed publications that successfully implemented telehealth services, which include evaluating

middle ear pathology, measuring tele-auditory brainstem responses using smartphone or iPad technology, and performing video otoscopy and synchronous (online) hearing testing in remote areas. Researchers determined the strengths, weaknesses, and clinical conclusions of said services, and evaluated the feasibility and validity of telehealth practice compared to traditional testing. Limitations of telehealth included a lack of diagnostic studies, inadequate staff training, and the need to standardize protocols and procedures to ensure consistency among service providers. However, the researchers concluded that the audiology services provided via telehealth were feasible and can be used to identify auditory pathology (Govender & Mars, 2017).

Surveys of hearing healthcare professionals took into account healthcare professionals' responses after using telehealth as a method of treatment. Singh, Pichora-Fuller, Malkowski, Boretzki, and Launer (2014) distributed an online survey to measure audiologists' attitudes toward teleaudiology appointments, their willingness to conduct different clinical tasks via teleaudiology, and their willingness to conduct teleaudiology appointments with different patient populations. A majority of participants felt that telehealth technology will have little to no effect on the quality of service a patient receives. Audiologists also felt that telehealth provision had an overall positive influence on the accessibility of audiological care (Singh et al., 2014). Similarly, Eikelboom and De Wet Swanepoel (2016) inquired about providers' potential to provide services remotely by surveying audiologists about their opinions on telehealth provision. Participants were asked a series of questions about the use of computer and video-conferencing technology, awareness and previous use of telehealth technology, and their willingness to use teleaudiology. Participating audiologists responded positively toward

teleaudiology and indicated a willingness to provide treatment using teleaudiology methods.

Hybrid studies that combine on-site and telehealth service provision have recently proven to be effective delivery methods for audiology services (Steuerwald et al., 2018). One study focused on the delivery of pediatric auditory services that included remote cochlear mapping, post fitting hearing aid checks, and device troubleshooting. Researchers created a training program for managing auditory devices for audiology staff and patients at a medical center. Participants received on-site training regarding the implementation and use of the software. Using video conferencing, patients were then able to communicate with their audiologists remotely to address patient concerns. If patient concerns could not be addressed via video conferencing, they were advised to schedule an in-person appointment with their audiologists. The primary concern for this method of service delivery was bandwidth connectivity and adequate signal transmission. The connection between both sites was occasionally compromised; however, the audiologists were able to address all the patient and caregiver concerns during the telehealth appointments once connectivity was maintained (Steuerwald et al., 2018). Another hybrid study combining on-site and telehealth services provided remote hearing aid follow-up appointments (Angley et al., 2017). 50 participants were seen in-clinic for a hearing aid consultation, then they were asked to install distance support (DS) client software on a personal device and participate in hearing aid follow-up appointments from home. After a period of receiving follow-up telehealth services, the results indicated that participants preferred DS appointments over in-clinic appointments, with the most cited reason for DS preference being time savings.

The current study will serve as pilot research for an educational audiology model in which both telehealth and on-site educational audiology services are delivered to one school district within the state of Mississippi. This project intends to identify a hybrid model for educational audiology service provision which will provide adequate educational audiology services to children with hearing loss in Mississippi schools. This study aims to answer the research question: *Will a combined telehealth and on-site hybrid model be effective in delivering appropriate educational audiology services to students with hearing loss in a Mississippi public school system?* Based on the success of the telehealth service models like that of Lancaster et al. (2008), combined with the need for educational audiologists and the outlook of telehealth practice, the researchers hypothesized that the hybrid model would be an effective method in providing educational audiology services.

Risks

The following measures were taken to prevent risks associated with the research. Electronic data was password protected. Any physical data was retained in a locked file cabinet. All responses from participants were categorized using a subject number with no identifying information attached. Numerical and statistical data organized by subject numbers were maintained in the principal investigator's office until no longer needed for presentation or publication purposes. At that time, all data collection and summary forms will be disposed of in an appropriate manner consistent with the University of Mississippi IRB guidelines.

IRB Approval

Approval to conduct research with human subjects was successfully given by the Institutional Review Board (IRB) at the University of Mississippi before any testing was conducted (Appendix A). Additionally, consent was provided to the participants (Appendix B).

CHAPTER III

METHODOLOGY

Participants

One school within Union County School District, West Union Attendance Center in New Albany, Mississippi, was recruited to participate in this study. Researchers contacted the school's speech-language pathologist (SLP), who acts as the school's primary advocate for students with communication disabilities. This school was selected to participate because of the number of students with auditory problems and a variety of educational audiology services needed.

Teachers Participants for this study included eight teachers, all females. All were willing to be observed within their classrooms, to receive suggestions from researchers, and complete data forms. Teacher #1 was a 6th-grade mathematics teacher. Teacher #2 was a special education teacher that provided supplemental instruction to students with disabilities or delayed learning impairments in kindergarten. Teacher #3 taught 6th-grade science and social studies courses. Teacher #4 was a kindergarten general education teacher. Teacher #5 taught 6th-grade English/language arts. Teacher #6 was a special education teacher, who provided instruction to 6th-grade students with hearing loss and disabilities. Teacher #7 was a 4th grade English/language arts teacher. Teacher #8 taught 4th-grade mathematics.

Students The school district had a total of 2,155 students, with four hard-of-hearing students enrolled. Student #1 was a 6-year-old female in kindergarten with a bilateral

severe to profound hearing loss. With bilateral hearing aids, her aided audiogram showed hearing thresholds in the moderate range. Student #2 was a 12-year-old male in 6th grade with a bilateral profound hearing loss. With a cochlear implant (CI) aiding his left ear, student #2's aided audiogram showed thresholds in the mild range. Student #3 was a 12-year-old male in 6th grade with a profound hearing loss in his right ear and a normal to mild loss in his left ear. With bilateral aids, his aided audiogram showed hearing thresholds which ranged from mild to moderate with no background noise present. Student #4 was a 6th-grade female who opted out of the study before any variables were implemented.

Procedure

Overall Programmatic Structure The hybrid program provided the following services to participants both on-site and via telehealth communication. On-site services provided by the investigators included: managing of the selection, purchase, installation, and evaluation of any large-area amplification systems, monitoring of personal hearing instruments including hearing aids, cochlear implants and FM technology (including but not limited to: recommending, fitting, evaluation and programming the hearing assistance technology), meeting with each child, providing counsel and advocacy training as needed, and participating in the development of an Individualized Education Program (IEP) or a Section 504. Tele-practice services provided by the investigators included: provision of individual training for professionals on the team when needed, provision of in-service programs for school personnel, consultation to educators as members of interdisciplinary teams about communication management, educational implications of

hearing loss and other auditory problems, educational management, classroom acoustics, and FM technology for children with hearing loss.

Initial Needs Assessment Before service provision, the school's SLP and special education director completed an overall needs assessment (Appendix C) via email to describe the range of audiological services needed among the student participants with hearing loss and their teachers. The survey assessed the current audiology services provided to the school system and asked the participants to rank on a scale of 1 (not important at this time) to 4 (critical need) the audiology services needed in the school district. The school district at large, the services already provided, the services needed, and the available budget were assessed. Additionally, each participating student's audiogram, audiology reports, previous year's grades, and current IEP/504 were reviewed, and the specific needs of each student were compiled. The survey also collected the number of students in the district who were identified as having hearing loss and who wear hearing aids or cochlear implants.

Outcome Measures a) The Teacher Self-Assessment (Appendix D) was a questionnaire used to collect feedback from teacher participants about the provided services. The structure of the assessment allowed teachers to elaborate on their opinions on the effectiveness of implementation and student outcomes. Answers to the assessment were provided verbally by participants and documented by researchers during a telehealth video conference. b) The Overall Effectiveness Assessment (Appendix E) assessed the teacher participants' judgments of the effectiveness of the services they received. Teachers were asked to quantify the effectiveness of on-site, telehealth, and hybrid model delivered services using a Likert-type ranking format; 1, indicating no effect, to 5,

indicating complete effectiveness. An option section for suggestions for improvements follow each indicator listed to obtain descriptive feedback from teachers. c) The Child Assessment (Appendix F) collected the grades of each student every nine weeks and compared with the previous year's grades corresponding to that point in time. Understanding that all variables influencing grades could not be controlled, at that point, the researchers planned to use the grades of the students as one indirect outcome measure for the effectiveness of the services provided.

Initial On-site Observations/Teacher Meeting The researchers observed for two periods before implementation. The purpose of this observation period was to obtain additional information about the audiological needs of the students before making recommendations for teachers. The researchers observed individual students with hearing loss in their separate classrooms during structural learning time. This allowed for a greater understanding of the audiological needs mentioned by the teachers and provided researchers insight to create their recommendations based on the students' and the individual classroom needs. Researchers were guided through observations using the Classroom Observation Checklist (Appendix G) from the *Educational Audiology Handbook* (1997). Researchers individually observed each of the four student participants among the five classrooms belonging to teacher participants. Researchers took detailed notes of physical characteristics (i.e. type of space, room size, number of students, type of seating used, lighting, windows, floor surface, wall surface, blackboards, room location, general noise level) of the space and teacher-student characteristics (i.e. child's seating, teacher's speech/noise level, teacher mobility, child's attention, child's speech in the classroom, child's speechreading skills, child's participation in class, child's social

interactions, friends of student, child's attendance, amplification) based on the outline from the Classroom Observation Checklist. General noise levels within classrooms and other spaces (lunchroom, gym, outdoor break area) were collected using the Decibel X application downloaded onto researchers' iPhones.

Researcher Meeting Following the first observation period, researchers held an on-site teacher introduction meeting, where the participating teachers were asked to elaborate individually on the challenges they faced teaching their student(s) who are hard-of-hearing. These comments were collected by researchers using a Microsoft Word document. Teachers were asked to choose the services most applicable to their needs and the audiology needs of their student(s) from the Overall Effectiveness Assessment (Appendix E). The assessments were administered on paper, and responses were collected and compiled using a Microsoft Word document.

After compiling the data collected during the initial observations and combining those with assessment of the teachers' needs, researchers used the IEP Checklist: Recommended Accommodations and Modifications for Students with Hearing Impairment (see Appendix H) from the *Educational Audiology Handbook* (1997) to select individualized list of recommendations for each teacher to implement in their classrooms for their student(s) with hearing loss. Recommendations were derived from the IEP Checklist and compiled based on each classroom's specific observations using a Microsoft Word document.

Online Conferencing Telehealth methods compliant with the Health Insurance Portability and Accountability Act (HIPAA) were utilized by researchers to relay the recommendations to the teacher participants using Zoom in a secure and private distant

site. During this teacher training period, researchers addressed each teacher's classroom needs and concerns individually using a Microsoft PowerPoint presentation. Teachers also received a copy of their individually compiled recommendations via email. Students were de-identified in the presentation and individual recommendation documents.

Follow-Up Assessments/Communication One additional on-site follow-up was made to observe the implementation of strategies provided to the teacher participants and to address concerns/issues with recommendations. Weekly email updates were submitted by the teachers that noted questions about strategies or challenges with implementation. Challenges were noted and addressed immediately with subsequent changes to improve the programming structure. Two telehealth conferences were held following the implementation of strategies, where teachers were provided consultation on educational management, classroom acoustics, and FM technology.

CHAPTER IV

RESULTS

Overall Effectiveness Assessment The Overall Effectiveness Assessment assessed the benefit of services implemented using a Likert-type indicator with a scale of one indicating no effect, to four, indicating complete effectiveness. Before the implementation of strategies, teachers were asked to indicate whether they did or did not want each service listed on the assessment. Those responses are indicated in the first column, with "yes" responses indicating they did request that the service be provided. No responses were given for services that were not requested. "Maybe" was indicated by one teacher, who at the time was unsure if the service was necessary. After the implementation of recommended strategies, each teacher participant individually gave a ranking for each service provided, and the average rank given by each teacher is displayed. Average scores were then accounted for a total average of overall effectiveness, which is displayed in the final row. The benefit of the services implemented indicated an overall effectiveness score of 3.84 out of 4.

Table 1: Initial Assessment Responses and Mean Effectiveness

Services	Initial (September 2019)	Follow-up (March 2020)
Measurement of noise levels in classrooms and provision of recommendations for environmental modifications	6 Yes	3.83
Management of the selection, purchase, installation, and evaluation of any large-area amplification systems	1 Yes	3.5
Monitoring of personal hearing instruments including hearing aids, cochlear implants and FM technology	2 Yes 1 Maybe	3.8
Oversight of the administration of hearing screening programs in school, training non-audiologists to perform hearing screening in the educational setting	2 Yes	3.8
Diagnosing, treating and managing any children with hearing problems	4 Yes	4
Meeting with each child, providing counsel and advocacy training as needed	1 Yes	4
Provision of individual training for professionals on the team when needed	2 Yes	3.83
Participation in the development of an Individual Education Program (IEP) or a Section 504	2 Yes	3.8
Provision of in-service programs for school personnel	1 Yes	3.83
Consultation to educators as members of interdisciplinary teams about communication management, educational implications of hearing loss and other auditory problems, educational management, classroom acoustics, and FM technology for children with hearing loss	3 Yes	3.83
To help with student transitions and "team with" school personnel to facilitate student learning	4 Yes	3.83
All needs were effectively addressed by on-site and telehealth consultation equally.	N/A	4
The duties provided by the audiologist were appropriate and effective via the method of provision.	N/A	3.83
The hybrid model is effective in meeting all the needs of the school personnel and students who have auditory problems.	N/A	3.83
	Overall Effectiveness Average:	3.836428571

The results of the Overall Effectiveness Assessment reflect the teacher's indication of the effectiveness of the services provided by the hybrid model. This high

average supported the benefit of the hybrid model of educational audiology service provision.

Teacher Self-Assessment Responses to the Teacher Self-Assessment were collected during a telehealth conference. Researchers used a semi-structured interview to allow teachers to elaborate on their responses. Researchers compiled the responses from five teachers and assessed common feedback, which revealed themes of increased confidence, knowledge and skills of both teachers and students. Four of the five teachers noted they observed an increase in their student's confidence levels with improved advocacy skills and increased communication with the teacher about their needs. When referencing confidence levels, two teachers reported observing social improvement, as students with hearing loss seemed more comfortable with their peers. Teachers also took notice of an increase in their own confidence levels. Three teachers commented that a better understanding of hearing loss has increased their insight in teaching these students, fostering improved student-teacher relationship. Teachers noted more occurrences where students felt comfortable to advocate for themselves.

Another theme was the feasibility of implementation. All responding teachers reported they were able to implement some if not all, strategies provided by the researchers. Among the strategies given, implementing noise-absorbing materials like rugs or carpet squares was the only recommendation that three of the five teachers reported as "not feasible." While these teachers made attempts to carry out this recommendation, all efforts were unsuccessful due to a lack of necessary funds from assigned classroom budgets. Aside from this recommendation, teachers overall reported

implementing other strategies with ease, such as modified seating arrangements, teaching techniques, and curriculum adjustments.

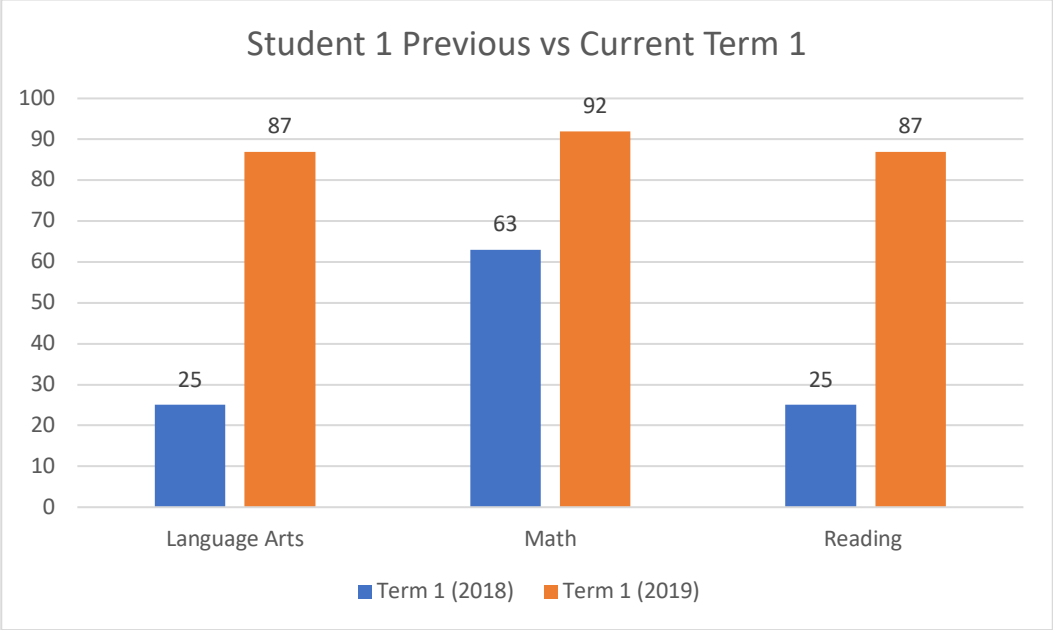
Grade improvement was another theme of discussion among teachers. Four of the five responders commented they had seen an increase in performance in individual assignments. One noted that grades were influenced when students began participating in strategies, creating motivation for both students and teachers. Another noted that compared to the prior year, she believed the grades her students made this year are dramatically higher. When comparing academic performance on a state level, one teacher indicated two students had increased performance by four categories in English since they began the school year.

The use of telehealth was commonly addressed. All responding teachers indicated they preferred using telehealth to receive updates, recommendations, and give feedback to the researchers rather than attending on-site follow-ups because of improved convenience and less time constraints.

Child Assessment The Child Assessment compiled the grades of each student served by the educational audiologist and were reviewed every nine weeks. Student #1's grades were compared with the previous year's grades corresponding to that point in time because she repeated kindergarten with the same teacher and material. Grades from her first year in kindergarten provided baseline data for her current year performance. Strategies provided to student #1's teachers were implemented within the first nine weeks of the current school year. Student #1's results revealed a significant increase from the previous year to the current year when intervention was introduced and consistency between scores each term for the current year. The primary recommendation that student

#1's teachers received was an adjustment to her IEP, which amended her curriculum by not testing subjects she was unable to understand because of her hearing loss. Her teachers were also given strategies to ensure the correct functioning of her hearing aids, including the Ling (1989) sound check. Her performance during the current term may be a direct reflection of the combination of these strategies.

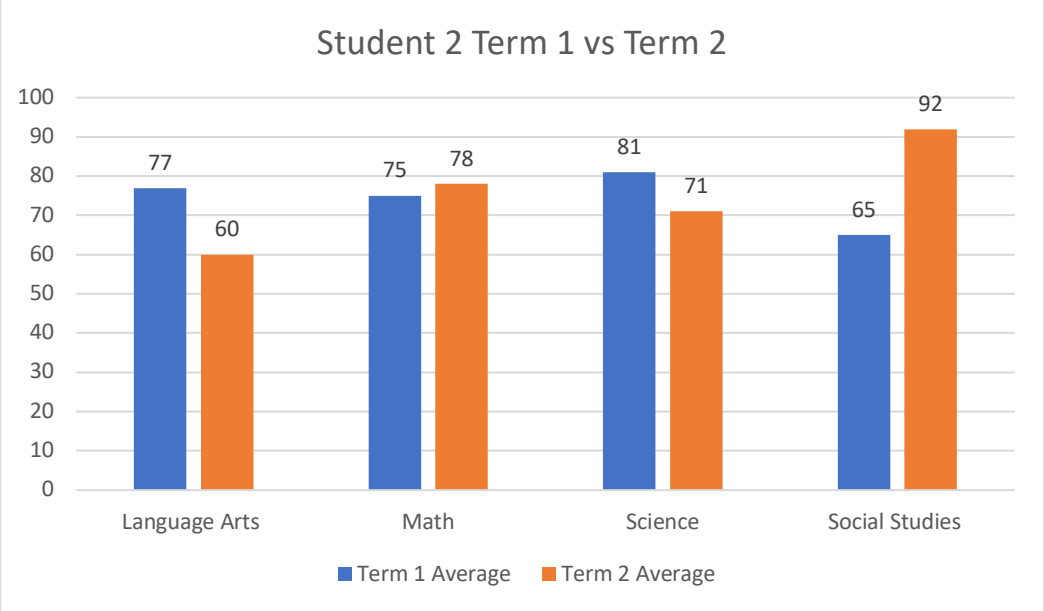
Figure 1: Student #1 Grades



Student #2 and #3's grades were compared based on progression per 9 weeks of the current school year. Because strategies for Student #2 and student #3 were implemented during the second nine weeks of the current school year, their first nine weeks performance acts as baseline data. Student #2's results indicate an improvement in social studies and math, but a decrease in performance in language arts and science. It was noted by his teachers that student #2 often lacked motivation in school performance.

He was known to turn off his CI when uninterested in certain subjects or overstimulated by the amount of noise present in the environment. His interest in subjects varied, as well as his connection with a certain teacher, which may have influenced his performance in certain classes. Student #2 primarily benefited from strategies that included a seating arrangement that optimized communication with his teacher and a buddy system designed for him to receive help from a classmate when necessary. His teachers also benefited from an FM system training, which may have contributed to his grade increase.

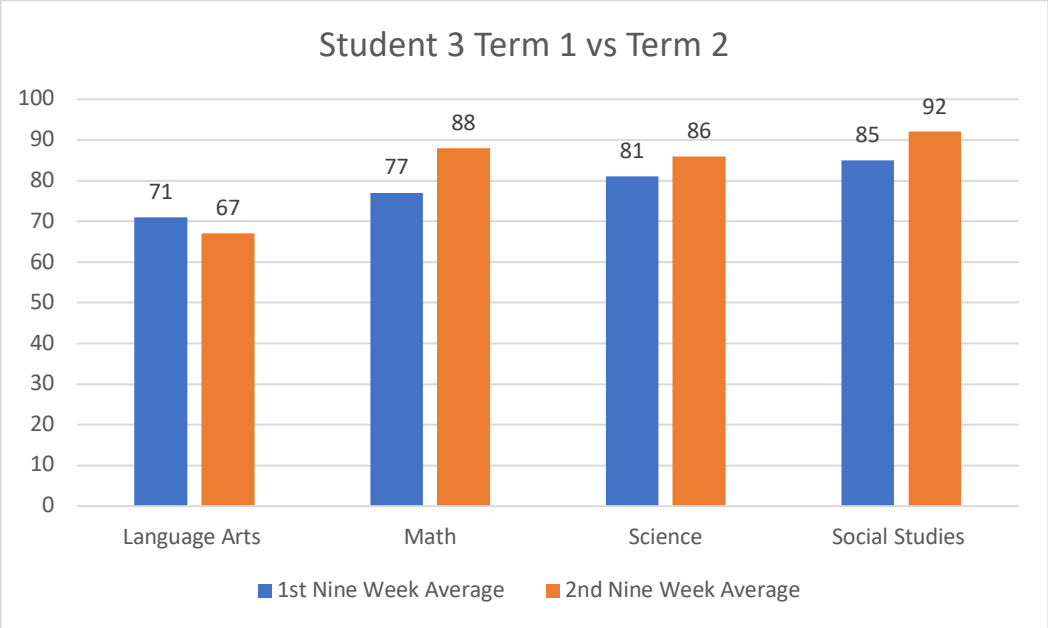
Figure 2: Student #2 Grades



Student #3's grades improved in the subjects of math and social studies, and science but decreased in language arts. Student #3's teachers noted he was often highly motivated to perform in academics. Similarly to Student #2, Student #3 benefitted from the researchers' suggested seating arrangement, as well as a buddy system. His teachers

received the same FM system training mentioned. Student #3 was known to frequently lose his hearing aids, which occurred once during the 2nd term. His performance variance may be dependent on the combination of these factors.

Figure 3: Student #3 Grades



Overall students' grades were better than the prior school year. However, the progress may have been mediated by the individual characteristics of each student, such as motivation, hearing aid not worn, or FM not utilized, and therefore considered an indirect outcome measure. Understanding that all variables influencing grades cannot be controlled for, at this point, the investigators utilized grade measurements of the students as an indirect outcome measure for the effectiveness of the services provided.

CHAPTER V

DISCUSSION

Summary of Findings

The current study intended to assess the efficacy of a combined telehealth and on-site model in delivering educational audiology services. The research considered the specific question: *Will a combined telehealth and on-site hybrid model be effective in delivering appropriate educational audiology services to students with hearing loss in a Mississippi public school system?* Results supported the efficacy of the hybrid model.

The Overall Effectiveness Assessment indicated an overall effectiveness average of 3.84 out of 4 for the hybrid model. On-site services included classroom observations and environmental sound level measurements. Services delivered via telehealth included classroom recommendations, teaching strategies, and technology training services. Themes assessed from the Teacher Self-Assessment included: increased student and teacher confidence levels, the feasibility of implementation of strategies, grade improvement, and preference for telehealth usage. Grade comparisons provided by the Child Assessment indicated an improvement in all subjects for Student #1, in two subjects for Student #2, and three subjects for Student #3. In consideration of the results provided in Chapter IV, the Teacher Self-Assessment themes and Overall Effectiveness results supported the methods used to provide educational audiology services.

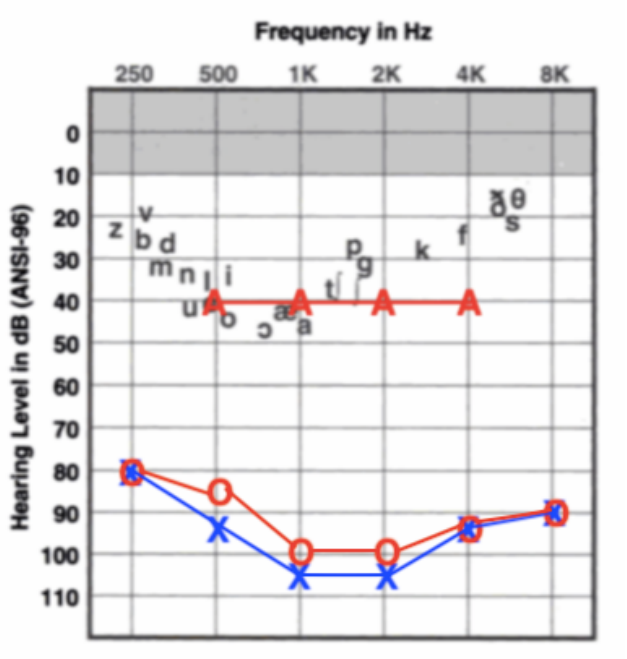
Discussion

As assessed in the literature review, an educational audiologist's role exists to deliver a range of audiology services for children with hearing and balance problems within educational settings (EAA, 2015). Specifically, educational audiologists perform specialized hearing measures and use evidence from classroom assessments to determine needed services, technology, and counsel teachers and students (EAA, 2019). The current study utilized the role descriptions to identify necessary services delivered on-site and via telehealth. Observation periods were designed to collect environmental sound level measurements in each participating teacher's classroom, evaluate teaching methods, and assess technology (FM, HAT, CI, etc.) usage. Services delivered via telehealth were met by recommendations created by researchers who compiled all observation data, gathered expertise of other investigators, and applied knowledge of audiology. These recommendations were delivered through a teacher training seminar, where teachers received teaching techniques and classroom modifications that would benefit their student(s) with hearing loss. These services also included managing HAT via telehealth, provided to the school's SLP in a training session that focused on proper function and use of each students' technology and troubleshooting techniques. Similarly to Steuerwald et al. (2018), who utilized telehealth to conduct follow-up meetings and provide participants with device troubleshooting methods remotely, success in service delivery via telehealth was observed in the current study. The online conferencing portion of the current procedure was designed similarly to address teachers' concerns and provide consultation on educational management, classroom acoustics, and HAT technology via telehealth. Table 1 indicated teachers felt that all needs were effectively addressed by both on-site

and telehealth consultation equally, consistent with Steuerwald et al.'s (2018) finding that all participants felt their needs were effectively addressed via telehealth. The overall effectiveness average also suggests that all services provided sufficiently met the educational audiology needs of students with hearing loss and their teachers.

As mentioned, ASHA (2015) categorizes four major areas that are impacted for a child with hearing loss, one of which is a reduction in academic achievement. Lower academic performance is depicted in student #1's Previous Term 1 (blue) grades in (Figure 1). ASHA (2015) also notes children with hearing loss are most often missing the softest phonemes. Figure 4.1 shows Student #1's phonetic audiogram, which indicates the softest level at which she can hear at differing frequencies while displaying where speech sounds occur. Student #1's audiogram indicates she is hearing sounds at 40 dB or higher, indicating a moderate hearing loss even with bilateral hearing aids.

Figure 4: Student 1's Phonetic Audiogram



These results signify the student does not hear a majority of speech sounds even with no background noise present, inhibiting her language development. Her performance in language arts and reading subjects are particularly impacted by her hearing loss (Figure 1), a consequence commonly indicated by other authors mentioned in the literature review (Tomblin et al., 2015; Moeller & Tomblin, 2015; Wake et al., 2004; Qi & Mitchell, 2012). Combined with their concern about her overall low academic achievement, student #1's teachers specifically noted a decline in her spelling performance. Researchers accordingly recommended that Student #1 receive an IEP modification in which her grades would not be penalized for sounds she cannot hear. The increase in grade performance indicated by Current Term 1 (orange) in Figure 1 is a direct result of this modification.

Both Angley et al. (2017) and Welch et al.'s (2017) findings reveal patients' preference to receive services via telehealth because convenience for patients was increased. A common inclination among the teachers participating in the research was to utilize teleconferencing to collaborate with researchers to receive educational audiology services. Most teachers noted they felt a significant amount of time saved when communicating via teleconferencing. The school's SLP reported that all teachers preferred to communicate with researchers using video teleconferencing when given the option to hold meetings either on-site or remotely. Utilizing telehealth allowed teachers to conveniently meet with researchers without rearranging their individual schedules for an organized on-site assembly.

Limitations

As indicated in the limitations of Steuerwald et al. (2018)'s study, connectivity between telehealth modems in each location must be maintained for the effective delivery of services. A challenge faced when obtaining responses to the Teacher Self-Assessment was a loss in connection during one of the telehealth conferences with a teacher, who had only limited time to answer questions and was no longer available once the meeting was reconnected. This factor prevented researchers from obtaining what may have been influential data about the overall effectiveness of strategies. Connectivity was regained following these disturbances, and communication between the researchers and the participants was continued.

Several uncontrolled factors that occurred throughout the research may have influenced the effectiveness of the hybrid model. For example, teachers often noted the lack of motivation some students experienced when discussing grade performance. Motivation may have been impacted based on the student's interest in the subject, attitude toward the teacher or classmates, participation in extracurricular activities, etc., which influence day-to-day participation in the classroom and performance on assignments. No amount of recommendations or modifications could be effective if the student simply chose not to participate in their learning. Technology issues also could account for poor classroom performance. There were several weeks throughout the intervention period that FM systems were not properly functioning, forcing students to depend solely on their technology (i.e. hearing aids, cochlear implants) without HAT usage. Misuse and/or defects in personal technology also posed an issue to classroom participation, as one

student went without the benefits of his hearing aids for weeks at a time because they were being repaired.

A barrier brought to the researchers' attention by the teacher participants was a lack of funding for certain strategies to be implemented. Installing noise-absorbing classroom materials was one strategy that none of the teachers were able to implement in their classrooms because of the costs of materials like carpet squares and rugs. West Union Attendance Center provides each teacher with a limited classroom budget each school year that allows purchases benefitting all members of the classroom. Purchases made specifically to aid students with hearing loss or other disabilities are categorized for payment by the school's special education budget, which did not have the necessary funds for these purchases at the time strategies were given to the teachers. Because of this factor, there were fewer opportunities to decrease classroom sound levels.

Strategies provided by the researchers were implemented based upon each teacher's discretion. Compliance to suggestions varied among teachers, who chose to what degree they felt comfortable implementing the strategies in their specific classrooms. For example, it was recommended to all teachers to speak individually with their student(s) with hearing loss about working together in the classroom to ensure an adequate listening experience. Some teachers did not feel this necessary and chose not to utilize this recommendation. Another recommended strategy was to establish a visual signal for students to inform their teachers that their HAT or FM devices were not functioning properly. These signals were not always utilized in every classroom, which may have influenced the students' motivation to self-advocate.

The sample size of both students and teachers was relatively small, limiting the ability to generalize the findings. However, the pilot research provides a foundation for future studies to produce methods applicable to a greater number of participants.

The researchers planned to include the students' grades from an additional nine weeks, however, data collection was ended prematurely due to unforeseen circumstances of COVID-19.

Implications for Future Research

The results of this study imply several directions for future studies. In consideration of the limitations mentioned, future researchers can prepare in advance for technology restrictions that arise by gaining a thorough understanding of the Zoom application, while relaying a type of training for future teacher participants using the application. Utilizing reliable technology that consistently maintains an internet connection would prevent telecommunication inhibitors.

Because the current research utilized a case study design, future researchers could benefit from implementing its methods in a larger number of schools and/or districts. Replication of the results will increase the generalizability of the findings. Future researchers can create additional direct measures of student academic success. As mentioned, several factors influenced the student participants' performance on graded work. Their grades may not be a direct reflection of the success of implemented strategies. However, the teacher participants often noted witnessing improvements to their student's attitude toward his/her hearing loss, social skills, and willingness to advocate. A measure collecting a student's perspective may provide researchers with sustainable data about the broader influence of given strategies.

Because determining overall effectiveness depended greatly upon teacher feedback, future research could consider an additional outcome measure of teacher stress. Greater insight into the feasibility of strategies could be provided by a teacher stress indicator.

Additionally, establishing a budget that includes the costs of implementing certain classroom modifications mentioned will remove the financial restriction teachers often faced when applying given recommendations to their classroom. Researchers can note that the budget for special education is established before each school year, so an estimated cost of recommendations could be provided to the school to ensure the budget is increased to include these costs. With adequate budgeting, recommendations that require purchasing material may be implemented with greater feasibility.

The success of implemented strategies could be further assessed had the researchers collected results over another nine weeks. It is recommended that future research implement variables and collect results throughout an entire academic year.

In conclusion**,** several points of interest were raised by the research provided. Specifically, more research is needed to better understand the effects of a hybrid model of educational audiology services on the academic, social, and developmental success of students. Additionally, the hybrid model sufficiently provided teachers with education and training to instruct students with hearing loss. The current research determined sound level measurements and classroom observations services can be successfully delivered on-site. Classroom recommendations, teaching strategies, and technology training services were effectively delivered remotely. The primary goal of this research was to effectively provide educational audiology services using a hybrid model of delivery. The

researchers hope that this study, as well as future studies derived from this research, will promote the expansion of educational audiology service delivery in Mississippi school districts.

APPENDIX A
IRB APPROVAL

PI:

This is to inform you that your application to conduct research with human participants, "Educational Audiology Model for Mississippi: Telepractice For Direct Service Provision" (Protocol #20x-101), has been approved as Exempt under 45 CFR 46.101(b)(#1)… "research on regular and special education strategies."

Please remember that all of The University of Mississippi's human participant research activities, regardless of whether the research is subject to federal regulations, must be guided by the ethical principles in The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research.

It is especially important for you to keep these points in mind:

- You must protect the rights and welfare of human research participants.
- Any changes to your approved protocol must be reviewed and approved before initiating those changes.
- You must report promptly to the IRB any injuries or other unanticipated problems involving risks to participants or others.
- If research is to be conducted during class, the PI must email the instructor and ask if they wish to see the protocol materials (surveys, interview questions, etc) prior to research beginning.

If you have any questions, please feel free to contact the IRB at irb@olemiss.edu.

Miranda L. Core & Mary K. Jourdan
Research Compliance Specialists, Research Integrity and Compliance
Office of Research and Sponsored Programs
The University of Mississippi
100 Barr Hall
University, MS 38677-1848
+1-662-915-7482
irb@olemiss.edu | www.olemiss.edu

REMINDER: YOU CANNOT HAVE CONTACT WITH RESEARCH SUBJECTS UNTIL YOU RECEIVE THE FORMAL IRB PROTOCOL APPROVAL LETTER OR EMAIL

APPENDIX B
CONSENT FORM

MANDATORY CONSENT FORM TEMPLATE
– ADULT –
(Non-Treatment Studies)

Consent to Participate in Research

Study Title: *Educational Audiology Model for Mississippi: Telepractice Plus Direct Service Provision*

Investigator/Faculty Sponsor
Rebecca Lowe, AuD
Department of Communication Sciences and Disorders SOC
University of Mississippi
University, MS 38677
(662) 915-7574
rl1@olemiss.edu

Key Information for You to Consider
• **Voluntary Consent**. You are being asked to volunteer for a research study. It is up to you whether you choose to participate or not. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate or discontinue participation. • **Purpose**. The purpose of this research is to identify a new model of educational audiology service provision which will work for the state of Mississippi until we reach the level of educational audiology in which other states have long achieved. • **Duration.** It is expected that your participation will last one academic year. • **Procedures and Activities.** You will be asked to implement certain strategies, technology, and modifications in your teaching of children with hearing impairments, and fill out a brief assessment form every nine weeks. • **Risks.** There are no risks to this research. • **Benefits**. Some of the benefits that may be expected include benefits to teachers and school personnel at administering appropriate services to hard of hearing children. • **Alternatives.** Participation is voluntary and the only alternative is to not participate.

☐ By checking this box I certify that I am 18 years of age or older.

What you will do for this study

1. You will not be filmed or recorded at any point in time during this research.
2. You will undergo teacher training during which researchers will train you in different strategies, technologies, and modifications that you will utilize in your classroom with hearing impaired children.
3. You will fill out an assessment every 9 weeks dictating the effectiveness of the new techniques.

Time required for this study

This study will last a full academic year.

Possible risks from your participation

There are no possible risks of your participation.

Benefits from your participation

Potential benefits are that teachers and school personnel may have an increased understanding of how to administer appropriate services to hard of hearing children.

Confidentiality
Electronic data will be password protected. Any physical data will be retained in a locked file cabinet. All responses from participants will be categorized using a subject number with no identifying information attached. Numerical and statistical data organized by subject number will be maintained in the principal investigator's office until no longer needed for presentation or publication purposes. At that time, all data collection and summary forms will be disposed of in an appropriate manner consistent with University guidelines.

Right to Withdraw
You do not have to volunteer for this study, and there is no penalty if you refuse. If you start the study and decide that you do not want to finish, just tell Rebecca Lowe. Whether or not you participate or withdraw will not affect your current or future relationship with the University of Mississippi.

IRB Approval
This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protection obligations required by state and federal law and University policies. If you have any questions or concerns regarding your rights as a research participant, please contact the IRB at (662) 915-7482 or irb@olemiss.edu.

Please ask the researcher if there is anything that is not clear or if you need more information. When all your questions have been answered, then decide if you want to be in the study or not.

Statement of Consent
I have read the above information. I have been given an unsigned copy of this form. I have had an opportunity to ask questions, and I have received answers. I consent to participate in the study.

Furthermore, I also affirm that the experimenter explained the study to me and told me about the study's risks as well as my right to refuse to participate and to withdraw.

Signature of Participant Date

Printed name of Participant

APPENDIX C
OVERALL NEEDS ASSESSMENT

1) Please describe the audiology services currently provided to your school system:

_____
_____
_____
_____

2) Please rank in order of importance on a scale of 1 (not important at this time) to 4 (critical need) the audiology services needed in your school district.

_____ Assistance with teacher training and professional development in the area of working with children who have auditory problems

_____ Assistance with appropriate modifications and accommodations of children with hearing loss in the classroom

_____ Assistance with implementation of hearing screenings and training of personnel

_____ Assistance with follow-up from failed hearing screening in diagnosing and treating children with hearing problems

_____ Assistance with development of appropriate goals for the IEP/504

_____ Assistance with noise level monitoring in classrooms and recommendations for modifications

_____ Assistance with selection of personal and/or large-area FM/amplification systems

_____ Assistance with monitoring of personal hearing instruments

_____ Consultation to the educators and active members of IEP teams

_____ Counseling with individual children as needed

Other needs not listed:

_____
_____
_____
_____

3) How many children with already identified hearing loss who wear hearing aids/cochlear Implants/FM systems do you have in the school district per grade? Please put the number by the appropriate amplification device.

Pre-K	_____/hearing aids	_____/cochlear implants	_____/FM systems
Kindergarten	_____/hearing aids	_____/cochlear implants	_____/FM systems
1st grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
2nd grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
3rd grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
4th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
5th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
6th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
7th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
8th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
9th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
10th grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
11st grade	_____/hearing aids	_____/cochlear implants	_____/FM systems
12nd grade	_____/hearing aids	_____/cochlear implants	_____/FM systems

4) How many children have an active IEP in your school district due to auditory problems? _____
5) How many children have a 504 plan in your school district due to auditory problems? _____
6) How many other children may need an IEP/504 due to auditory problems? _____

APPENDIX D
TEACHER SELF-ASSESSMENT

Name: _____ School: _____ Date: _____

1. How effectively do you feel you have implemented the given strategies?

2. What strategies were easy to implement?

3. What strategies were more difficult to implement but still possible?

4. What strategies were not feasible to implement? Why?

5. Have you had any problems with any of the recommendations or strategies you were given? (Such as issues with amplification, devices, room acoustics, room setup, teaching strategies, curriculum modifications, meal times, break room, rotations, etc.)

6. Have you had any communication issues with your students with hearing loss?

7. How effective do you believe the strategies have been for the students with hearing loss?

8. What improvements, if any, have you seen in your students with hearing loss since implementing the given strategies?

9. Are there any other problems or issues you would like addressed?

APPENDIX E
OVERALL EFFECTIVENESS ASSESSMENT

SCHOOL PERSONNEL: EFFECTIVENESS ASSESSMENT FOR AUDIOLOGY SERVICES IN THE SCHOOLS

Teacher _____ Grade: _____

Date _____

STATUS

EFFECTIVENESS INDICATORS For ON-SITE SERVICES	1 – not effective	2 – somewhat ineffective	3 – somewhat effective	4 – completely effective	SUGGESTIONS
Measurement of noise levels in classrooms and provision of recommendations for environmental modifications					
Management of the selection, purchase, installation, and evaluation of any large-area amplification systems					
Monitoring of personal hearing instruments including hearing aids, cochlear implants and FM technology					
Oversight of the administration of hearing screening programs in school, training non-audiologists to perform hearing screening in the educational setting.					
Diagnosing, treating and managing any children with hearing problems					
Meeting with each child, providing counsel and advocacy training as needed					

EFFECTIVENESS INDICATORS For TELEPRACTICE SERVICES	1 – not effective	2 – somewhat ineffective	3 – somewhat effective	4 – completely effective	SUGGESTIONS
Provision of individual training for professionals on the team when needed					
Participation in the development of an Individual Education Program (IEP) or a Section 504					
Provision of in-service programs for school personnel					
Consultation to educators as members of interdisciplinary teams about communication management, educational implications of hearing loss and other auditory problems, educational management, classroom acoustics, and FM technology for children with hearing loss					
To help with student transitions and "team with" school personnel to facilitate student learning.					

EFFECTIVENESS INDICATORS For HYBRID MODEL	1 – not effective	2 – somewhat ineffective	3 – somewhat effective	4 – completely effective	SUGGESTIONS for IMPROVEMENT
All needs were effectively addressed by both audiologists equally					
The duties provided by the audiologist were appropriate and effective via the method of provision.					
The hybrid model is effective in meeting all the needs of the school personnel and students who have auditory problems.					

APPENDIX F
CHILD ASSESSMENT

CHILD ASSESSMENT FORM

School Name _____ Child Number _____ Current Grade _____

Term (1st, 2nd, 3rd, 4th nine-weeks)	PREVIOUS GRADE _____ grade		CURRENT GRADE	
	CLASS	Grades	CLASS	Grades
1st term				
2nd term				
3rd Term				
4th Term				

School Name _____ Child Number _____ Current Grade _____

Term (1st, 2nd, 3rd, 4th nine-weeks)	CURRENT GRADE	
	CLASS	Grades
1st term		
2nd term		
3rd Term		
4th Term		

APPENDIX G
CLASSROOM OBSERVATION CHECKLIST

CLASSROOM OBSERVATION CHECKLIST

I. Physical Characteristics

1. Type of School:
- a. Open space ___
- b. Modified open space___
- c. Traditional ___
- d. Other ___

2. Room Size:
- a. Large ___
- b. Medium ___
- c. Small ___

3. Number of Students in Class

___

4. Number of Teacher Aides:
- a. Full-time ___
- b. Part-time ___

5. Types of Seating Used:
- a. Desks ___
- b. Tables and chairs ___
- c. Chairs with writing arms ___
- d. Combination of tables and desks ___
- e. Other (identify) ___

6. Lighting:
- a. Adequate ___
- b. Not adequate ___

7. Windows:
- a. Complete wall ___
- b. Individual windows___
- c. Covered (describe)___
- d. None ___

8. Floor Surface:
- a. Rubber tile ___
- b. Hardwood ___
- c. Carpeting ___

9. Wall Surface:
- a. Wood ___
- b. Brick ___
- c. Acoustic tile ___
- d. Other ___

10. Blackboards:
- a. Visible to child ___
- b. Teacher usage:
  - a. Good ___
  - b. Fair ___
  - c. Poor ___
- c. Glare ___

11. Room Location:
- a. Next to disturbing space: Describe:_____ _____

12. General Room Noise Level:
- a. High ___
- b. Medium ___
- c. Low ___
- d. SPL ___

II. Teacher-Student Characteristics

13. Child Seating is:
- a. Appropriate ___
- b. Inappropriate___

14. Teacher's Speech/Voice
- a. Loud ___
- b. Soft ___
- c. Well modulated ___
- d. Good articulation ___
- e. Poor articulation ___
- f. Good voice quality___
- g. Poor voice quality___
- h. Readability of lips:
  - a. Good___
  - b. Fair___
  - c. Poor___

15. **Teacher Mobility:**
    a. Faces children when speaking ___
    b. Moves while speaking___
    c. Uses hand gestures while speaking___
    d. Talks with back to class___

16. **Child's Attention:**
    a. Always attends to speaker___
    b. Usually attends to speaker___
    c. Sometimes attends to speaker___
    d. Rarely attends to speaker___
    e. Difference between attending to teacher and classmate (describe) ___

17. **Child's Speech in Classroom:**
    i. Very intelligible___
    ii. Usually intelligible___
    iii. Unintelligible___
    iv. Teacher shows adequate comprehension of child's speech___

18. **Child's Speechreading Skills**
    a. Speechreading utilized___
    b. Speechreading not utilized___
    c. Speechreading skills are successful:
        i. Large group___
        ii. Small group___
        iii. Not at all___

19. **Child Participates in Class:**
    a. Volunteers information___
    b. Answers questions when they are directed to him/her

Appendix H
IEP Checklist

IEP CHECKLIST: RECOMMENDED ACCOMMODATIONS AND MODIFICATIONS FOR STUDENTS WITH HEARING IMPAIRMENT

Amplification Options

____ Personal hearing device (hearing aid, cochlear implant, tactile device)
____ Personal FM system (hearing aid + FM)
____ FM system/auditory trainer (without personal hearing aid)
____ Walkman-style FM system
____ Sound-field FM system

Assistance/devices

____ interpreter
____ TV captioner/real time captioning
____ Other: _____

Communication Accommodations

____ Specialized seating arrangements: - _____
____ Obtain student's attention prior to speaking
____ Reduce auditory distractions (background noise)
____ Reduce visual distractions
____ Enhance speechreading conditions (avoid hands in front of face, mustaches, well-trimmed, no gum chewing)
____ Present information in simple, structured, sequential manner
____ Clearly enunciate speech
____ Allow extra time for processing information
____ Repeat or rephrase information when necessary
____ Frequently check for understanding
____ Educational interpreter (ASL, signed English, cued speech, oral)

Physical Environment Accommodations

____ Noise reduction (carpet & other sound absorption materials)
____ Specialized lighting
____ Room design modifications
____ Flashing fire alarm

Instructional Accommodations

____ Use of visual supplements (overheads, chalkboard, charts, vocabulary lists, lecture outlines)
____ Captioning or scripts for television, videos, movies, filmstrips
____ Buddy system for notes, extra explanation/directions
____ Check for understanding of information
____ Down time/break from listening
____ Extra time to complete assignments
____ Step-by-step directions
____ Tutor
____ Note taker

Curricular Modifications

____ Modify reading assignments (shorten length, adapt or eliminate phonics assignments)
____ Modify written assignments (shorten length, adjust evaluation criteria)
____ Pre-tutor vocabulary
____ Provide supplemental materials to reinforce concepts
____ Provide extra practice
____ Alternative curriculum

Evaluation Modifications

____ Reduce quantity of tests
____ Use alternative tests
____ Provide reading assistance with tests
____ Allow extra time
____ Other modifications: _____

Other Needs/Considerations

____ Supplemental instruction (speech, language, pragmatic skills, auditory, speechreading skills)
____ Counseling
____ Sign language instruction
____ Vocational service
____ Family Supports
____ Deaf/hard of hearing role models
____ Recreational/social opportunities
____ Financial assistance
____ Transition service

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