



# Opportunities and Challenges for AI-Based Support for Speech-Language Pathologists

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## ABSTRACT

Speech-Language Pathologists (SLPs) are professionals who work with children and adults in the prevention, assessment, diagnosis, and intervention for speech, language, and communication difficulties. This research investigates the experiences and perceptions of SLPs regarding the potential for Artificial Intelligence (AI) technologies to support their work. Through a series of three studies, including an online survey, an Asynchronous Remote Community (ARC), and an observation of online communities, we comprehensively explored the challenges faced by SLPs and identified areas where AI-based technologies can offer support. This paper addresses four key areas: 1) the reported needs, constraints, and challenges faced by SLPs in their work, 2) the current perspectives of SLPs on AI and technology, 3) the adoption of AI-based tools by SLPs since the release of advanced generative AI technologies, and 4) the aspects of SLPs' work that can be supported by AI-based tools to increase capacity and improve job satisfaction. Findings from this research contribute to a deeper understanding of SLPs' professional environment and offer insights into the potential benefits and considerations of and design directions for integrating AI into Speech-Language Pathology practice.

## CCS CONCEPTS

• **Human-centered computing** → **Interaction design**; • **Social and professional topics** → **User characteristics**; • **Computing methodologies** → **Artificial intelligence**.

## KEYWORDS

Speech and language difficulties, AI prototyping, Natural language processing, Human-centered design

## ACM Reference Format:

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## 1 INTRODUCTION

In the United States, there are 3.4 million children served under the Individuals with Disabilities Act [1]. More than half of those require the support of speech-language services provided by speech-language pathologists (SLPs) [3, 54]. SLPs work with both children and adults in the areas of prevention, assessment, diagnosis, and interventions for speech, language, and communication difficulties [9]. They often work in private practice as well as school-based settings and are a critical part of supporting children with specific learning disabilities and people with language difficulties [9]. However, the demand for these services typically exceeds the capacity of the existing SLP workforce [2, 15, 66]. Moreover, access to support from SLPs is limited in rural areas or for those from underserved communities [30], which has only been exacerbated since the COVID-19 pandemic. SLPs often have incredibly high caseloads and spend a large amount of time on administrative tasks such as preparing materials for therapy sessions, matching evidence-based interventions to their client's needs, writing reports after each session, and preparing for Individualized Education Program meetings [15]. Because of this, despite SLPs in general having a high level of job satisfaction, there are still high rates of burnout [28, 44]. If parts of the job of SLPs could be made easier, they may be able to have more manageable caseloads, expand their access, and spend more of their time doing the work they find most meaningful, such as working directly with their clients.

Since late 2022, the world has seen an explosion of capability and access to Artificial Intelligence based tools and the introduction of accessible tools for Generative AI, including that of large language models like *GPT 4* and image generation tools like *DALL-E 2*. There is a huge opportunity for AI-based tools to transform many different types of careers, and the application of AI holds great promise in the field of Speech-Language Pathology. AI demonstrates strengths in language comprehension [61], automation of routine tasks [68], and



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creation of personalized materials [22]. While no AI could replace the crucial human-to-human contact that SLPs provide in their services, the work of SLPs may be particularly amenable to support by these AI-based tools, given how much of their work is reliant on speech, language, and communication. Moreover, SLPs spend a significant amount of time tailoring experiences for the individual client and then documenting their sessions in a structured format. These activities could take advantage of the strengths of AI language tools like large language models (LLMs) and automatic speech recognition (ASR).

In a typical session with an SLP, a child may need to practice speaking different words and matching them with pictures as part of articulation exercises and language comprehension activities. The SLP may start by presenting the child with a set of word-picture pairs related to the target sounds or phonemes they are working on. The child is then encouraged to say the word out loud, paying attention to the specific sounds and articulation. If the child struggles to produce a particular sound, the SLP may demonstrate the correct tongue placement or provide verbal instructions on how to position their tongue. As the session progresses, an SLP may introduce additional challenges or variations. For instance, they may increase the complexity of the words or incorporate game-like elements to keep the session engaging and challenging for the child. Throughout the sessions, an SLP monitors the child's progress and adjusts the level of support or difficulty as needed to optimize learning outcomes. Following such sessions, SLPs generate "SOAP notes," a structured documentation used in healthcare settings, including speech therapy. SOAP stands for Subjective, Objective, Assessment, and Plan. In these notes, the SLP records subjective information about the session, such as the child's demeanor, followed by objective data, such as specific exercises practiced and the child's performance. In the assessment section, SLPs document their professional analysis of the session outcomes and the child's progress towards therapy goals. Finally, the plan outlines future steps, including recommendations for further therapy sessions or adjustments to the treatment plan. AI might be used to help SLPs prepare materials for these sessions, provide fine-grained data on the child's speech, or automate the creation of SOAP notes, reducing the documentation burden so that SLPs can focus more on providing care for their clients.

Motivated by a desire to support the work of SLPs and their adult and child clients and recognizing the potential for AI to transform their working lives, we took a human-centered design approach to identify the opportunities, challenges, and design directions for the use of AI in enhancing the practice of SLPs. Our research questions include:

- RQ1. What are the needs, constraints, and challenges SLPs currently face in their work that could be addressed with AI? What aspects do they enjoy most about their job that should not be negatively impacted by AI?
- RQ2. What are the current perspectives and concerns of SLPs on AI?
- RQ3. How are early SLP adopters using AI-based tools in their practice since the release of *ChatGPT* and *DALL-E 2*?
- RQ4. What aspects of SLPs' work can be supported by AI-based tools to increase capacity and improve job satisfaction?

We conducted a mixed methods study with SLPs, which included a survey with 105 SLPs and observations of SLP social media communities on Reddit and Facebook to understand their use of publicly available AI-based tools. We also conducted 5-weeks of co-design activities with 12 SLPs using an Asynchronous Remote Communities approach [42], including a diary study and review of AI-based tools. Each of these studies triangulate across different aspects of SLPs' jobs to identify opportunities and challenges for AI-based support for their careers. Through these investigations, we identified SLPs' needs, constraints, and challenges in their daily work; their attitudes, expectations, and potential reservations towards AI technology; their current adoption patterns and emerging trends in the integration of AI technologies into SLPs; and opportunities and areas AI-based tools can enhance capacity and improve job satisfaction for SLPs. The findings showed diverse needs and challenges SLPs have in their work and aspirations they have in harnessing the power of AI-based tools to streamline various aspects of SLPs practice.

This work can help to ensure that AI-based speech therapy tools accurately reflect and respond to the needs of SLPs, such as creating personalized plans and monitoring progress, and have greater success in enhancing the overall effectiveness and accessibility of speech therapy and alleviating the stress and burnout SLPs face.

## 2 BACKGROUND & RELATED WORK

To gain insights into how SLPs approach and perceive the use of AI-based speech therapy tools, we first offer an overview of their roles, working environment, and the factors that influence their work. This is followed by a review of prior research on AI-based speech therapy tools.

### 2.1 Speech-Language Pathologists

The American Speech-Language-Hearing Association (ASHA) define a speech-language pathologist (SLP) as "*the professional who engages in professional practice in the areas of communication and swallowing across the life span*" [10, p.2]. Here, communication refers to facets of "speech production and fluency, language, cognition, voice, resonance, and hearing" [10, p.2], while swallowing includes related feeding behaviors [10]. Within the United States, the majority of SLPs currently hold a master's degree in speech pathology or a clinical doctorate in audiology [6], have clinical experience, and maintain an ASHA certification for school employment [31]. However, across the nation, there exists a diverse spectrum of service providers with different levels of training and certification [31]. Additionally, it is important to note that standards for providing speech and language therapy services differ across the globe, with these services being sparse in low and middle-income countries [11, 64]. Furthermore, in many regions of the world, the profession of SLP does not exist [19] or there is an inadequate number of SLPs to meet the needs of individuals [11].

The roles and responsibilities of SLPs are diverse and varied as they not only provide assessment, diagnosis, and treatment services, but they also engage in counseling, prevention, wellness activities, and collaborative efforts. Despite the importance of their work, SLPs face considerable challenges that impact their job satisfaction and well-being. Numerous studies have examined the factors

associated with job satisfaction, stress, and burnout among SLPs [15, 25, 32, 43]. A primary contributor to stress and burnout is the demanding nature of their workload that is compounded by their overwhelming caseload sizes [15, 32]. Across the United States, as SLPs are being increasingly tasked with managing larger and more culturally diverse caseloads, they have reported that navigating time constraints to deliver “optimal service has become an ethical challenge” [43, p.2]. Additionally, significant administrative responsibilities such as paperwork, insurance claims, lack of co-worker support, and limited access to resources and fiscal constraints, especially in public school settings, also emerge as significant stressors leading to burnout [15, 25, 32, 43]. Furthermore, members of underrepresented communities, including Black, indigenous, people of color (BIPOC), and the LGBTQIA+ community, may face heightened stress in their work environment due to challenges such as social differences and biases and discrimination in the workplace [5, 26, 43]. According to a 2021 survey conducted by ASHA, 3.6% of speech-language pathologists and audiologists identify as Black/African-American, 3.1% as Asian, 1.5% as multiracial, and less than 1% each as American Indian/Alaska Native or Pacific Islander [7]. This disparity poses various challenges for BIPOC SLPs, such as reported higher caseloads and workloads [16, 27], often stemming from translation requests for documentation and client services, with little recognition of the extra workload involved [43].

To address challenges faced by SLPs in providing optimal care, researchers have proposed AI-based automated speech therapy tools using AI techniques such as machine learning and deep learning for individuals with speech and language difficulties [21, 24, 55, 59, 63]. Not only can AI-driven technology alleviate SLPs’ burden of delivering and executing interventions, but its scalability may also have the potential to help reach out to broader populations who have been underserved [46, 52, 58]. The following section provides an overview of related work on automated speech therapy tools using various AI techniques, highlighting their contributions to improving the efficacy and accessibility of speech therapy interventions.

## 2.2 AI-based Automated Speech Therapy Tools

Researchers have employed various AI and machine learning techniques to enhance the efficacy of speech therapy interventions, ranging from personalized treatment plans to real-time feedback systems that monitor the progress of clients. These methodologies include the integration of quantitative data like facial expressions and intonations to automate various aspects of care, such as analyzing learning patterns, identifying speech difficulties, and dynamically adjusting instructional strategies [23, 38]. For example, to provide insights for SLPs into client’s articulation patterns, Bilkova et al. [14] trained a Convolutional Neural Network (CNN) and utilized Augmented Reality (AR) to capture lip, tongue, and teeth movements during speech therapy exercises. In another study, to mimic the work of SLPs, Robles-Bykbaev et al. [59, 60] proposed a robotic assistant to motivate children during therapy activities while providing real-time feedback. Similarly, Ng et al. [49] and Sztaho et al. [67] developed a fully automated speech therapy tool by displaying visual feedback on intensity, intonation, and rhythm to children with hearing impairments.

Building on Human Computer Interaction (HCI) principles, Desolda et al. [21] took a participatory approach to designing automated speech therapy tools by emphasizing the role of caregivers, children, and SLPs in the design of a remote therapy tool that evaluates the correctness of the speech exercises and gives real-time feedback. Similarly, another study used a co-design technique with SLPs to include their perspectives throughout the design process of a goal setting tool that aimed to support the dialogue between SLPs and parents and enhance shared decision-making about children’s communicative participation goals [65]. Many studies have also incorporated “serious games” as an intervention tool for children [20] as AI-driven speech therapy tools might evoke excitement and foster companionship [20]. For example, Hernandez et al. designed a serious game that provided real time feedback for children who were hard of hearing [17]. In another similar study, Ramamurthy et al. introduced a therapeutic robot named “Buddy” for children with cleft lip/palate [55]. Buddy, a companion robot, allowed children to practice speech exercises at home while facilitating remote monitoring by SLPs [55]. This set of work serves as early examples of the potential for AI in directly supporting children in speech therapy. Our work considers more broadly how these types of tools might play into the overall job satisfaction of SLPs.

**2.2.1 Generative AI for Speech Therapy.** The recent surge in the popularity of generative AI and Large Language Models (LLMs) has led to a growing recognition among both researchers and care providers of the potential benefits of leveraging Generative AI for speech therapy. In an effort to explore the clinical utility of *ChatGPT*, a study by Du et al. [22], explored the potential adoption of *ChatGPT* in speech-language therapy. By having an ASHA-certified speech-language pathologist evaluate the responses generated by *ChatGPT* for language intervention activities, the study identified the LLM’s potential in translating and generating therapy materials, which includes areas such as vocabulary development, narrative skills, language comprehension, literacy, and bilingual therapy [22]. Furthermore, *ChatGPT* also showed capabilities in simulating human-like communication related to grammar, syntax, pragmatics, and cultural competence [22]. Moreover, Du et al. also highlighted the potential of integrating *ChatGPT* with other generative AI tools like *DALL·E 2* for replacing traditional “worksheets and flashcards [22].” Additionally, because the generated images do not contain any confidential information about actual clients, these visuals can aid in the therapy process to demonstrate both fictional and non-fictional scenarios [22]. Our research is interested in exploring the potential for these types of approaches more broadly across all aspects of an SLP’s working life.

## 3 METHODS

To comprehensively understand the experiences and perceptions of SLPs, we conducted a series of three studies. These studies, collectively, enabled us to triangulate to explore the challenges SLPs currently face in their work, their current perspective of SLPs on AI, how early adopters are using AI-based tools in their practice, and which aspects of SLPs’ work can be supported by AI-based tools. Each method brought unique insights, enriching our understanding. All studies were reviewed by the Institutional Review Board (IRB) at the University of Washington and classified as exempt research.

### 3.1 Survey with SLPs

We first conducted an online survey to gather insights and learn about the experiences from SLPs. The online format of the survey provided convenience for participants, while ensuring a broader reach within the SLP community.

**3.1.1 Recruitment.** We disseminated a brief description of the study, along with a QR code and a link to the online survey, through the American Speech-Language-Hearing Association (ASHA) mailing list and the Division for Early Childhood (DEC) newsletter. To extend our reach, researchers created and shared posts containing a link to the survey on relevant online communities (e.g., Facebook groups). We also distributed business cards featuring the QR code to the survey at a booth at the November 2023 ASHA convention. We then used snowball sampling to encourage participants to share the survey within their professional networks. The survey was open for completion from June 29, 2023 to present day. We report on the responses collected up to Jan 5, 2024.

**3.1.2 Instrument.** The survey consisted of three sections: demographics, experiences as an SLP, and perceptions of AI and current technology use at work, collecting both qualitative and quantitative data. In the demographics section, participants were asked to provide information about their age, gender, years of experience, primary work setting, and age group they primarily work with. The "Experiences as an SLP" section delved into the nuances of the profession, prompting participants to reflect on three open-ended questions: 1) the three things they enjoy the most about being an SLP, 2) the three biggest challenges they face, and 3) the things they do at work that they feel are the least impactful use of their time. Lastly, the survey included a section on the perceptions of AI and current technology use, which included questions about participants' familiarity with AI technologies and their current use of technology in their practice.

**3.1.3 Spam Filtering Process.** During the survey administration period, the survey was targeted by spammers, resulting in a sudden surge of fraudulent participant responses, which is becoming increasingly common in human-computer interaction research. As online surveys become more common with the COVID-19 pandemic, the risk of fraud has increased [41]. To mitigate the impact of these spammers, we implemented a multiple stage filtering process.

- **Web Search:** Because many SLPs have public-facing websites for their school or home practices, we conducted web searches using combinations of survey respondents' names and the term "SLP" to verify the authenticity of participants' identities. This step aimed to identify any discrepancies or inconsistencies in the information provided by respondents.
- **Review of Responses:** Researchers manually reviewed responses to open-ended questions to assess the genuineness and relevance of the answers provided. Responses that appeared suspicious or inconsistent were flagged for further investigation. Three researchers independently reviewed the dataset and assigned scores of 1, 0, or -1 to each response (1 indicating the researcher is certain that the respondent was a genuine SLP, 0 indicating the researcher is not certain, and -1 indicating the researcher is

**Table 1: Reported Participant Demographics**

Social Category	Participant Demographics (n=105)
Gender	92.4% Woman, 6.7% Man, 1% Non-binary
Race	3.2% Asian, 3.2% Black, 88.4% White, 1.1% Prefer Not to Say
Ethnicity	91.4% Not Hispanic or Latino, 8.6% Hispanic or Latino,
Age Range	30.5% 25-34, 23.8% 35-44, 29.5% 45-54, 13.3% 55-64, 2.9% 65+
Years of Experience	4.2% 1-3, 6.3% 3-5, 24% 5-10, 65.5% 10+
Age of Clients*	26.7% 0-3, 58.1% 3-5, 71.4% K-5, 29.5% Middle School, 23.8% High school, 11.4% Adult Learners
Community Setting	32.4% Urban, 12.4% Rural, 55.2% Suburban
Work Setting*	66.7% Public school, 14.3% Private practice, 15.2% Early Intervention, 23.8% Other

\*some participants were counted twice based on their answers

certain that the respondent was fraudulent). Subsequently, the researchers convened to reconcile any discrepancies in coding.

We acknowledge that this stringent filtering process may have led to the exclusion of genuine SLP respondents who lacked public profiles or provided brief responses, however, it was deemed necessary to ensure the integrity of the dataset.

**3.1.4 Participants.** Through the combination of web searches and manual review, a total of 18 responses from fraudulent participants were identified and excluded from the dataset. Additionally, one response from a graduate student, whose status did not align with the target participant criteria (professional SLP with experience), was also removed. After filtering, a total of 105 responses from authentic SLPs were retained for analysis. Table 1 provides descriptive statistics regarding the demographics of the study participants, presenting a diverse cross-section of professionals in the field. The majority of the participants in our study identify as women (92.4%) and White (88.4%), which is similar to the SLP demographics data reported by ASHA in 2022 (96.4% Female and 91.2% White) [8]. The age distribution showcases a spread, with the largest group falling within the 45-54 age range (29.5%). The study participants also have considerable professional experience, with 65.5% having over 10 years of experience in the field. Additionally, they represent diverse age groups and work in varied settings, with 66.7% in public schools and 14.3% in private practice.

**3.1.5 Data Analysis.** We analyzed qualitative data from the open-ended questions using thematic analysis. Two researchers independently coded responses to identify recurring themes related to the three aspects of participants' experiences as an SLP. We resolved discrepancies in coding through discussion until we reached consensus. Quantitative data was analyzed using descriptive statistics.

### 3.2 Asynchronous Remote Communities (ARC)

The Asynchronous Remote Communities (ARC) method is a flexible research method that leverages digital platforms, such as Slack or

online forums (e.g., private Facebook groups), to facilitate asynchronous discussions and connect participants in a private, internet-based setting [42]. Researchers can deliver research tasks periodically and gather information about their perceptions in a format that is lightweight, accessible, usable, and low burden [13]. Because the ARC method allows participants to engage at their own pace and convenience, it increases flexibility for participants. In addition, ARCs can accommodate people from diverse geographic locations, making it particularly suitable where synchronous interaction may be challenging or impractical [45]. In this research, we used the ARC method to connect SLPs from different locations across the United States.

**3.2.1 Participants & ARC platform.** From a larger pool of respondents from a prior survey study in section 3.1, we employed a purposive sampling strategy to select participants for the ARC activities based on their expressed interest in further engagement and their diverse professional backgrounds. We chose participants to represent a range of experiences and perspectives within the field of speech-language pathology, including different practice settings and levels of expertise. We sent an email invitation containing a study overview and a link to an online information sheet that resembles an informed consent form to eighteen selected SLPs. Thirteen signed the information sheet and were introduced to the private Slack group we set up for the study and provided with instructions on how to post messages and share documents on Slack. Twelve joined the group and participated in the study. All participants were holders of the Certificate of Clinical Competence in Speech-Language Pathology (CCC-SLP). See Table 2 for ARC participant details.

We chose the Slack platform<sup>1</sup> for the ARC study because 1) it can easily facilitate asynchronous discussions, 2) it supports the use of pseudonyms and allows participants to preserve anonymity, if they want to, 3) it supports rich document and media sharing, and 4) it can be accessed across multiple devices (e.g., via computers, tablets, or mobile devices).

**3.2.2 Activity Prompts and Procedures.** Participants participated in Slack activities, such as sharing their answers to the prompts and responding to others' posts, asynchronously. A summary of these activities is provided in Table 3. We designed the prompts to include both recall (e.g., A2. Diary Study) and generative activities (e.g., A5. Envisioning AI in Speech-Language Pathology & Exploring *ChatGPT*) to offer variety and different modes of engagement, as encouraged by previous ARC studies [42]. We also designed prompts to accommodate the often busy, multitasking lives of SLPs and to typically take 20-30 minutes to complete. To ensure participant privacy, we offered an option to share responses to activity prompts privately via direct messages on Slack or email to research team members and it was a preferred mode of sharing for some participants. Within the Slack channel, four research team members were present to moderate the discussion, answer questions from participants, and respond to participant posts with emoji reactions and replies to encourage engagement. We hoped that discussions and interactions would naturally occur among participants in Slack, but participant interactions were limited to emoji reactions on each

other's posts. One team member was in charge of providing activity prompts and sending reminders to complete the activity. In appreciation for participation, we provided a gift card of \$10-\$50 for each online activity, commensurate with the time investment.

**3.2.3 Data Analysis.** Our data analysis involved a comprehensive review of participant contributions, including posts, comments, responses within Slack channel, as well as data from activities such as diary entry prompts, stakeholder circle drawings, ideas and reflections after exploring AI in Speech-Language Pathology. Researchers reviewed and identified recurring themes, patterns, and insights emerging from participant inputs. Through this process, the research team discerned commonalities and variations in participant experiences and perspectives.

### 3.3 Observation of Online Communities

Lastly, we conducted observation studies across relevant online communities in a social listening approach [53]. Observation of online communities involves systematically observing and analyzing interactions, discussions, and activities within virtual communities or online platforms [50]. Two researchers immersed themselves in relevant online spaces to gain insights into the attitudes of SLPs toward use of AI in speech-language pathology practices. We specifically designed this approach to capture qualitative discussions occurring organically within the SLP community around the use of AI-based tools.

**3.3.1 Data Collection.** Data collection involved observation of multiple online communities, including both public and private platforms. The primary sources comprised a Reddit community of Speech-Language Pathologists (*r/slp*) and a private Facebook group dedicated to discussions on AI in the field of Speech-Language Pathology. (Speech Pathology AI: Tech for SLP/SLT and SLP-A Therapy). We chose these two communities because they complemented each other, providing a comprehensive dataset for analysis. The SLP subreddit had a broad spectrum of SLPs, however, discussions primarily revolved around general topics of speech language pathology rather than being centered around AI. In contrast, the private Facebook group comprised a smaller subset of SLPs engaging in more concentrated and in-depth discussions around AI within the field of Speech-Language Pathology. Additionally, we conducted searches and reviews of articles about AI for speech language therapy that were publicly available online, such as news articles and blog posts authored by SLPs. Table 4 summarizes the sources we used for online observation.

It was important to maintain the integrity and privacy of private online group members, and we were committed to ensuring that our research did not disrupt the normal activities within the group. Therefore, researchers adopted the role of "complete observer," as defined by Nørskov [50]. With this approach, we refrained from active participation and passively observed interactions from the sidelines. We did not create posts, ask questions, respond, or engage with group members and respected established guidelines and adhered to group rules during our observation. This allowed researchers to maintain objectivity and minimize potential biases in data collection.

<sup>1</sup><https://slack.com/>

**Table 2: ARC Participant Information**

PID	Age	Gender	Race/Ethnicity	Years of Experience	Practice Location
ARC1	25-34	Woman	White	7	Suburban
ARC2	25-34	Woman	White	9	Urban
ARC3	25-34	Woman	Asian, White	8	Urban
ARC4	25-34	Woman	White	5	Rural
ARC5	25-34	Woman	White	8	Suburban
ARC6	35-44	Woman	White	20	Rural
ARC7	35-44	Woman	Hispanic or Latino, White	9	Suburban
ARC8	45-54	Man	White	20	Rural
ARC9	45-54	Woman	White	15	Urban
ARC10	65+	Woman	White	50	Urban
ARC11	55-64	Woman	White	35	Urban
ARC12	25-34	Woman	Asian	9	Urban

**Table 3: Summary of activities on the private Slack group**

#	Name	Activity	Shared*	G/R**
A1	Introduction & Ice breaker	Get to know each other by creating a post about yourself <ul style="list-style-type: none"> <li>Name / pseudonym</li> <li>A picture and brief description of an interest fuels your passions.</li> <li>One aspect you love about being an SLP</li> <li>What you would like to get from this research</li> </ul>	D	G & R
A2	Diary study	Reflect on your work day and submit a diary via Google Form including: <ul style="list-style-type: none"> <li>Key tasks and sessions</li> <li>Achievements and successes</li> <li>Challenges faced</li> <li>Communication and collaboration</li> <li>Magic wand</li> </ul>	N	R
A3	Capturing Work Environment	Share photos/videos of a workspace capturing: <ul style="list-style-type: none"> <li>Spaces (e.g., therapy rooms, classrooms, virtual meeting setups)</li> <li>Tools (e.g., speech therapy materials, assessments)</li> <li>Work preparations (e.g., how and where you prepare materials and resources for sessions, creative setups you have, organizational tips)</li> <li>Digital technologies (e.g., programs, apps, assistive technologies)</li> </ul>	D/P	G & R
A4	Stakeholder Circles	Think of the people involved in working with children with speech and language difficulties and visually represent them in circles. <ul style="list-style-type: none"> <li>Identify the Stakeholders</li> <li>Draw circles of *perceived* closeness to other stakeholders</li> <li>Draw circles of *expected* closeness to other stakeholders</li> </ul>	D/P	G
A5	Envisioning AI in Speech-Language Pathology & Exploring ChatGPT	<b>Part 1.</b> Watch two videos on AI and SLP and think about the potential impact of generative AI on speech-language pathology. How could AI support children with speech and language difficulties? How do you want AI to support your practice? <b>Part 2.</b> Generate at least three prompts centered around speech and language difficulties on <i>ChatGPT</i> . Interact with <i>ChatGPT</i> by tweaking the prompt and see how it changes the responses.	D/P	G

\***Shared:** D = Responses were shared Directly to the group | N = Responses were Not shared with the group | D/P = Responses were shared directly to the group or privately with the researchers, depending on participant's preference

\*\***Generative/Recall (G/R):** G = Activity involved Generating new material | R=Activity involved Recalling past experience

**Table 4: Source of Observations**

Source	Access	# of members	# of posts reviewed
SLP Subreddit	Public	44.3k	40
Private Facebook Group for SLP and AI	Private	2.7k	37
Online Articles about AI for SLP	Public	N/A	16

For the private Facebook group observation, we followed the digital research ethics guideline outlined by Kozinets [12, 37]. We first clearly communicated our affiliation and intentions to the community moderators and obtained their permission to observe and collect data within the group. Two researchers conducted observations, documenting their findings. In the SLP subreddit, to center our observation around AI and SLPs, we searched for terms related to AI (e.g., AI, *ChatGPT*, *Bard*, *DALL·E 2*). Meanwhile, in the Facebook group observation, we reviewed all posts in the group because all discussions were on topic and the number of posts were manageable as the group was created in November 2023.

**3.3.2 Data Processing & Analysis.** Because the primary objective of our observation was gaining insights from SLPs, rather than scrutinizing their group dynamic, we refrained from documenting user names in our notes. As a result, we opted to use generic descriptors such as "Reddit user" and "Facebook group member" when quoting from these sources. When we incorporate direct quotes from online communities, we paraphrased them to safeguard the privacy and anonymity of the original contributors and prevent search engines from identifying the individuals who posted the content [35]. We first reviewed discussions on the online communities and familiarized ourselves with the data. Upon completion of the observation, researchers compiled and organized the collected data for subsequent analysis. We then reviewed and identified recurring themes, patterns, and insights emerging from the community discussions. Through this process, the research team was able to understand how SLPs currently use AI-based tools in their practices.

## 4 RESULTS

### 4.1 RQ1: What are the needs, constraints, and challenges SLPs currently face in their work?

RQ1 aimed to delve into the landscape of SLPs' professional environment, with a specific focus on identifying their needs, constraints, and challenges. By exploring these aspects, we sought to gain an understanding of the factors that influence SLPs' work dynamics and effectiveness, ultimately informing strategies and interventions aimed at enhancing their practice and addressing existing gaps or barriers.

In our survey with 105 SLPs, we asked them to share the three biggest challenges in their job when working with children with speech/language difficulties. Time management and availability emerged as the most prevalent issue, with more than half of respondents citing it as a challenge. SLPs expressed frustration over

the lack of time for preparation, planning, and direct intervention with children and families. This sentiment was echoed in responses such as "*Lack of time to properly prepare therapy (S27)*" and "*short amount of time with EI (Early Intervention) families (S30)*" highlighting the need for more resources and support in managing their time effectively. Another major challenge identified was caseload size and workload. Many SLPs reported feeling overwhelmed by the sheer volume and variety of needs across their caseloads, making it difficult to provide individualized attention to each client. Quotes like "*High caseloads (S32, S35, S36, S51, S60, S69)*" and "*Caseload too large to give each student the time and individual attention that they need (S16)*" underscored the strain imposed by excessive workloads. Administrative and paperwork challenges were also mentioned frequently, respondents stating excessive paperwork and inefficient documentation systems as significant obstacles of their work. SLPs expressed frustration over spending more time on paperwork than on actual therapy with children, highlighting the need for streamlined processes and administrative support. One SLP stated, "*The amount of paperwork is never-ending. (I have) limited time for direct intervention due to the amount of paperwork (S82)*" and other SLPs shared similar experiences "*More time paperwork/IEP (Individualized Education Program) than providing treatment (S15)*" and "*Inefficient systems for paperwork (S10)*." This underscores the need for solutions that help SLPs with administrative tasks, allowing them to focus more on providing quality care to their clients.

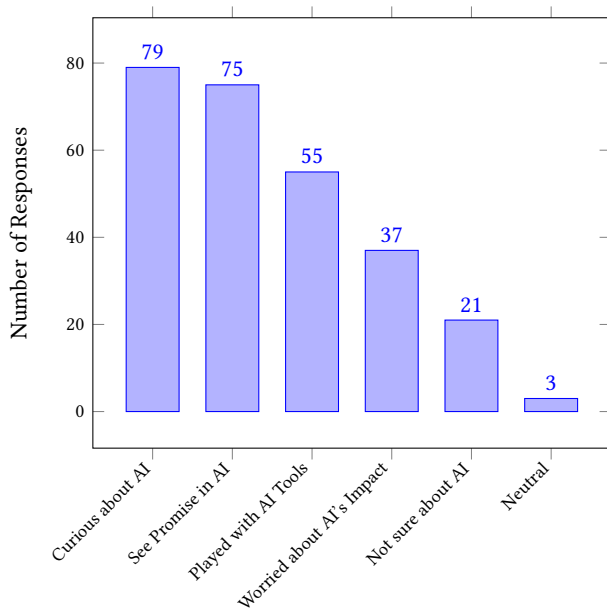
Another hurdle identified was the engagement of parents and caregivers in the therapy process. This included encouraging parent involvement and ensuring consistent follow-through with home programs between sessions. SLPs often encountered difficulties in "*getting buy-in from families (S45)*" and providing adequate caregiver education and support, especially in the home setting (S19). The issues around scheduling also came up frequently, as SLPs struggle to find sufficient time in their busy schedules to work with clients without conflicts. This includes coordinating schedules around geographic locations (S45), family commitments, and ensuring that therapy sessions do not interfere with important class information or learning (S79, S83).

### 4.2 RQ2: What is the current perspective of SLPs on AI and technology?

RQ2 sought to uncover insights into the attitudes, expectations, and potential reservations of SLPs towards AI technology. This investigation provides insights for the integration of AI into speech-language pathology practice and the development of supportive frameworks that align with SLPs' needs and aspirations. The survey data revealed how SLPs view the integration of AI into their field, as shown in Figure 1. Participants expressed a keen interest in exploring the potential applications of AI tools and technologies to enhance their work and improve outcomes for their clients and students but some also expressed their concern around the technology.

**4.2.1 Interest in Technology and AI.** SLPs demonstrated a high level of curiosity and enthusiasm for AI, particularly regarding its potential applications in speech-language pathology in the survey. A central motivation for SLPs in AI technology is the desire to better





**Figure 1: SLPs' perception of AI Technologies**

serve their clients and students. Survey respondents expressed their interest in learning more about AI as they consider it a potential tool that can facilitate progress, improve communication abilities, and support students' needs. S36 said, "I would like to better understand AI and how it can support my work with students to improve their communication abilities." Efficiency and time-saving was another major factor driving interest in AI among SLPs. Many participants expressed a desire to explore new tools, strategies, and technologies to reduce administrative burdens. AI tools were perceived as valuable potential resources for automating paperwork and non-therapy tasks, thereby allowing SLPs to allocate more time and energy to client-centered activities. In addition, some expressed interest in staying informed about cutting-edge technologies and collaborating with colleagues and researchers to leverage AI effectively. S85 noted, "I am interested in learning cutting edge technology tools that would save time and money for SLPs" and S26 said, "I would love to be part of a shift in our field to hopefully automate some of the paperwork that is time-consuming."

**4.2.2 Concerns and Considerations.** While many participants expressed enthusiasm and interest in the potential applications of AI within speech-language pathology, some raised concerns and considerations. A subset of SLPs expressed they struggled with technology and keeping up with it in a rapidly evolving world. For example, S17 listed "Keeping up with technology" as one of their top three challenges. Also, when asked about their current approach to technology tool use in SLP practice, 32.4% chose "I am interested in trying new technology tools but I do not have time," reflecting time constraints SLPs face in adapting a new technology and two respondents chose "I try to avoid technology as much as possible (S27, S41)", showing some populations may not be ready to embrace new technology. Furthermore, privacy concerns around AI emerged

among participants who expressed their reservations. S10 noted, "(I am concerned that) new technologies such as automated transcription of language samples require use of software that doesn't meet FERPA<sup>2</sup> or HIPAA<sup>3</sup> and/or companies collect data in a way that compromises privacy." Some expressed apprehension about the ethical implications of AI, cautioning against the potential misuse of technology in place of hiring human professionals ("I see the potential for its use in our field but also fear some places may misuse it in place of trying to actively hire SLPs" – S60). Additionally, a few respondents raised ethical considerations surrounding use of AI in general, about its impact on artistic expression and intellectual property rights, reflecting broader societal concerns about the responsible use of AI technology [40].

**4.2.3 Potential for Perspective Change.** The ARC Activity 5 provided participants with an opportunity to interact with *ChatGPT* and explore its potential applications in speech language pathology. *ChatGPT* was chosen for this activity because it allows one to experience the capabilities of Generative AI in a conversational context, providing insights into its language understanding and generation abilities. Following the interaction, we encouraged participants to articulate their insights on the prospective usefulness of AI as well as feedback on desired features or modifications they would like to make on *ChatGPT* or similar AI tools. To facilitate their engagement, we provided some ideas to inspire explorations as follows "You can explore areas like word generation (e.g., "generate 20 words that use the 'ph' sound"), creating stories (e.g., "write a story for a 6 year old child to read that uses all of the phonemes"). You can also ask *ChatGPT* about therapy techniques, strategies, recommendations on assessment tools and resources, and/or to compose a letter to someone, etc. Tweak the prompt and see how it changes the responses. Try writing more complicated prompts, and challenge *ChatGPT*." Participants identified specific areas where *ChatGPT* could offer tangible benefits, particularly in administrative tasks. Participants shared how their perspectives of AI changed after this exercise. For instance, ARC3 shared "I have been hesitant about using *ChatGPT* for my personal use, but this exercise opened my eyes to a lot of ways that it could be used in clinical practice and training. I can see this being used as a great way to generate relevant materials/probes for therapy. In addition, it could be used to develop case examples for clinical training. In both cases, this takes away some of the 'grunt work' and allows for more focus on the teaching/training rather than generating materials." And the other participant (ARC2) noted "After exploring more and using *ChatGPT* for the first time, (...) I think AI could be really beneficial in making initial contact with outside agencies for referrals, getting IEPs, and previous medical records. I usually type each email individually, but if there was an easy way to (create) a template/initial letter quickly, it'd shave a bunch of time on administrative duties." These responses underscore the potential of greater acceptance of AI-based tools that optimize workflow processes and improve productivity within the speech-language pathology field.

<sup>2</sup>Family Educational Rights and Privacy Act

<sup>3</sup>Health Insurance Portability and Accountability Act



### 4.3 RQ3: How are SLPs adopting AI-based tools in their practice since the release of ChatGPT and DALL·E 2?

For RQ3, we examined the adoption of AI-based tools by SLPs, using data from discussions within SLP online communities like private Facebook groups and the SLP subreddit. By analyzing the tips, anecdotes, and firsthand experiences shared by SLPs in these online forums, we aimed to identify early adoption patterns and emerging trends in the integration of AI technologies into SLPs daily clinical workflows. While we recognize that early adopters may not be representative of a broader set of SLPs, these early uses can be indicators of the potential for AI's application in the field.

**4.3.1 Preparing Therapy Materials with Personalized Learning and Instruction.** SLPs use AI tools like *ChatGPT* to prepare personalized therapy materials such as flashcards, worksheets, or interactive games tailored to the specific needs and goals of each client. These materials can be designed to target language, articulation, fluency, or other areas of speech and language disorders. A Reddit user noted, *"I've been using it to generate evaluation templates, goals, classroom support strategies for various disorders, and sentences/paragraphs/stories that contain a ton of the targeted sounds."* AI-powered tools are also being used to create multilingual handouts for effective communication with caregivers who are not native English speakers. *"I've used it to translate handouts into Spanish, asked it 'translate this into 8th grade reading level Spanish, using the ud. form' and it did a great job! (Reddit\_user)"* SLPs also leverage text-to-image AI models to create images. *"starting to use DALL·E 2 and bing.com/create to generate custom treatment stimuli/images. (Reddit\_user)." Apart from the mainstream generative AI such as ChatGPT and DALL·E 2, the Facebook group members also recommended other AI tools such as Ambiki<sup>4</sup>, which has some "AI/generative language features, especially for notes." SLPs in the Facebook group also shared that they have used an AI tool for lesson planning called *magicschool.ai* when one group member asked for recommendations for lesson planning with groups of 3-4 students.*

**4.3.2 Writing Documentation.** SLPs need to create numerous documents in their work such as therapy goals, progress reports, therapy notes, and reports summarizing test results. In online SLP communities, SLPs frequently share how they use AI-based tools to optimize their documentation processes. For instance, in response to a post asking for a program that can automate the incorporation of parent responses from a speech/language intake report in Word document, a fellow Facebook group member shared, *"In response to your inquiry about optimizing evaluation reports, I'm in the process of creating a Google Form for speech/language intake. After collecting responses (ensuring privacy by removing personal details), you can efficiently transfer this data into ChatGPT alongside a preset prompt template and your evaluation notes. This approach can greatly expedite the report writing process, using AI to structure and incorporate information seamlessly into a Word document!"* Beyond typical clinical documentation, SLPs also have used AI applications in writing other types of documents, such as a maternity leave letter or resignation letters.

<sup>4</sup><https://ambiki.com/>

**4.3.3 Create Resources or Tweak Resources.** SLPs shared helpful resources on how they can use AI to increase the efficiency of their practice. For example, one Facebook group member posted about a book published on January 18, 2024 with a title of, *"Maximizing Speech Therapy with Artificial Intelligence: Tools and Tech for SLPs, SLTs, and SLP-As 1 [4]."* Similarly, with the launch of GPT Store, some of the Facebook group members have also developed their own custom version of the GPT (Generative Pre-trained Transformer) model tailored to support SLPs in their work. For example, one group member shared *"Speech-Language Pathologist Helper"*, a custom resource for creating customized therapy materials that enables personalized and effective therapy material creation. Other group members shared another custom GPT titled, *"SLP Goal Writer"* that can help in writing SMART goals for speech-language pathology and streamlines the goal-setting process, ensuring clarity and precision. SLPs were also getting creative and effectively using resources not originally intended for speech-language pathology in their practice. For example, they use *YARN*<sup>5</sup>, where you can enter a snippet of dialogue and get video clips that feature that dialogue, to find the source of the script and get a better idea of what it might mean for Gestalt Language Processing (GLP) clients. Also, one Facebook user recommended *Recast AI*<sup>6</sup>, which turns articles into mini podcasts. They added, *"perfect for us SLPs always on the move. I'll be sharing some neat SLP articles here in audio form. Great for listening while you're commuting or just chilling."*

**4.3.4 Share Tips with Other SLPs.** SLPs actively shared tips and insights with their peers to enhance their practice within these online forums. One common topic of discussion is what prompt to use to elicit better responses, also known as prompt engineering. They exchanged ideas on the prompts they used and strategies to refine them. For example, a Facebook group member shared *"pro tip: you can upload previous goals you've written (with identifying info removed of course) and ask it to write in a similar style."* Often-times, for those new to generative AI tools, the more experienced ones shared the prompt they used such as *"create a goal for a kid with the following: Lateral lisp for the /s/ and /z/ phonemes (e.g., house, puzzle), Vocalic /r/ distortion (e.g., door, spider, guitar, tiger), Distortion of the /t/ phoneme."* Tips on ways to address privacy concerns were also discussed within SLP communities, emphasizing the importance of removing all identifiers before using AI tools to ensure client confidentiality and ethical practice. One Facebook group member shared, *"When utilizing ChatGPT, it's advisable to remove all identifiers before inputting the information."* and the other echoed the same messages saying *"remove all identifiers. Any name. School name, kid name, teacher name. Any name."* SLPs also acknowledged the limitations of AI and shared that *ChatGPT* should be used as a starting point and not an end point, highlighting the importance of human review and refinement of AI produced work, stating, *"Your expertise is invaluable in the final quality check."*

<sup>5</sup><https://getyarn.io/>

<sup>6</sup><https://letsrecast.ai/>

#### 4.4 RQ4: What aspects of SLPs work can be supported by AI-based tools to support increased capacity and improve job satisfaction?

SLPs handle numerous tasks in their daily work, ranging from documentation to care coordination to billing. With RQ4 in mind, we explored the landscape of SLPs' professional environment by focusing on identifying areas where AI-based tools can offer support. Through survey data and diary studies (ARC Activity 2), we explored SLPs' perspectives on the least impactful use of their time, as well as their desires for streamlining tasks through the metaphorical "magic wand" (e.g., "If you had a magic wand, what would you have used it for to make your job easier today?") We aimed to uncover opportunities where AI-based tools can enhance capacity and improve job satisfaction for SLPs.

**4.4.1 Documentation.** The survey data revealed that SLPs considered tasks such as documenting therapy sessions, writing progress reports, and handling ineffective meetings as least impactful uses of their time. As one respondent lamented, *"Making copies, uploading paperwork, electronic systems that have the capability of automating some of the tasks, but management that hasn't provided access to those capabilities. (S10)"* The responses to the Magic Wand question further underscore the desire for solutions to streamline workflows and alleviate administrative burdens. Many ARC participants expressed a wish for automation and efficiency in documentation processes, with one stating, *"My magic wand would take away the need for session notes. (ARC5),"* echoing the frustration of repetitive and time-consuming paperwork. SLPs expressed a desire for efficiency and automation to alleviate this burden, as seen in requests for *"an automated tool to help me classify 'urgent vs. not-urgent' email (ARC12)"* and *"Documentation! Wave it away! (ARC3)"*

**4.4.2 Care Coordination.** Care coordination tasks—such as providing access to specialist support, scheduling meetings, and communicating with other stakeholders such as parents and teachers—resonated with many participants as areas of frustration. ARC3 shared, *"Scheduling is always something I wish could be easier. We have a lot of tools for communication and organizing our schedule (e.g., Teams, texting, emails for communication; Outlook calendars and our EMR for scheduling), and sometimes I feel that there is a lot of redundant internal work to document our 'admin' tasks. For instance, when I schedule with a family, I have to reach out to the family via their preferred communication method (phone call, email, text), then I have to document this contact attempt on our EMR system, then I have to block the held appointment time on our EMR system, and then I have to export my EMR schedule to Outlook for my coworkers to view so that I don't get accidentally booked for a meeting time that I have offered to a family. I think it is sometimes assumed that scheduling should be pretty straightforward, but this little task for one family easily turns into a 5 minute task to thoroughly complete our internal documentation."* Also, ARC3 emphasized the need for better communication tools to facilitate scheduling and coordination: *"Every parent is different. Our EMR already sends out automated texts, but many families seem to ignore these and seem to need personalized texts/reminders to remember appointments"* Others longed for technology that works seamlessly, such as an app for scheduling or

automatic appointment reminders. These challenges contribute to inefficiencies and detract from direct patient care, highlighting the need for innovative solutions to support SLPs in their practice.

**4.4.3 Billing.** Billing and insurance-related tasks emerged as significant burdens for SLPs, with respondents expressing frustration with handling insurance claims and managing billing processes. S17 said, *"Talking to Insurance companies (being on hold for hours, not being able to understand the representatives),"* highlighting the time-consuming nature and complexity of interacting with insurance providers. Additionally, other respondents (S8, S41, S47, S81, S92, S102) cited Medicaid billing as a specific area of concern, indicating the challenges associated with navigating different insurance systems and requirements. Moreover, respondents expressed dissatisfaction with the administrative burden associated with logging contact time with students for third-party billing purposes, as one participant stated, *"Logging my contact time with students in ways that are necessary only for the purposes of third party billing, rather than only in ways that would serve my practice and document that I was meeting IEP minutes. (S79)"* These challenges underscore the need for streamlined billing processes and efficient management of insurance-related tasks to minimize administrative burdens and allow SLPs to focus more on patient care.

## 5 DISCUSSION

### 5.1 Design Recommendations

Overall, the findings showed challenges SLPs have in their work and aspirations they have in harnessing the power of AI-based tools to streamline various aspects of SLPs practice. In this section, we present how AI-based tools might be designed to alleviate the challenges encountered by SLPs, offering avenues for the automation of repetitive tasks and the streamlining of workflows.

**5.1.1 Administrative Work.** AI-based tools can offer support to SLPs with a few aspects of administrative burdens by automating various aspects of the process [29, 56]. For example, AI-powered speech-to-text technology can expedite the documentation of therapy sessions by transcribing spoken words into written text, reducing the time and effort required for manual note-taking. This automation not only increases efficiency but also allows SLPs to focus more on interacting with their clients during sessions. Moreover, AI-based tools can assist with writing progress reports by analyzing data and generating summaries of insights based on the information collected during therapy sessions [56]. By leveraging natural language processing and machine learning algorithms, AI tools can identify key trends, milestones, and areas of improvement, helping SLPs produce comprehensive and informative progress reports in less time [39, 56]. AI can also assist with categorizing and prioritizing tasks, such as classifying emails or session notes as urgent or non-urgent, based on predefined criteria. Furthermore, AI-based documentation solutions can mitigate the administrative burden associated with paperwork by automating repetitive tasks and eliminating manual data entry. For example, AI algorithms can identify and extract relevant information from documents, such as patient records or assessment forms, and populate EMR (Electronic Medical Record) systems with accurate and up-to-date data [29]. This not only reduces the risk of errors, but also enhances

the overall accuracy and completeness of documentation, thereby improving the quality of care provided by SLPs.

**5.1.2 Session Preparation and Planning.** AI could assist in preparing therapy materials and lesson planning by generating personalized therapy materials tailored to individual patient needs. For example, AI algorithms can analyze patient data, such as speech patterns, language samples and language proficiency to generate customized therapy exercises and activities and recommend specific evidence-based interventions that match the current needs of their clients. AI-based tools can also assist with formulating specific and measurable goals and creating lesson plans that may be tailored to the client's specific interests (e.g., like has been done for autism interventions [47]) and/or tailor toward the client's cultural background [51]. This not only can save time for SLPs but also ensures that therapy materials are targeted, effective, and engaging.

**5.1.3 Care Coordination.** AI can play a significant role in helping SLPs manage their time more effectively by automating various aspects of appointment management and communication. For example, AI-powered scheduling algorithms can automate appointment scheduling to optimize scheduling efficiency. AI-powered scheduling systems can also assist with the process of coordinating appointments by integrating with existing communication channels, such as email, text messaging, and phone calls. These systems can automatically send personalized reminders and notifications tailored to individual preferences, reducing the likelihood of missed appointments and facilitating better attendance rates.

**5.1.4 Billing and Insurance Management.** AI-based tools have potential to help SLPs through automating tasks like billing, handling insurance claims to free up time for SLPs to focus on core responsibilities [34]. For example, AI-powered chatbots or virtual assistants can handle routine inquiries and administrative tasks, such as verifying insurance eligibility, submitting claims, and resolving billing issues. Also, AI assistant tools designed to handle the time-consuming task of waiting on hold during phone calls, such as Hold for Me by Google Assistant, can alleviate the frustration of being on hold for extended periods and struggling to understand insurance representatives [34]. Moreover, AI algorithms can analyze billing data and identify patterns or discrepancies that may impact reimbursement, helping SLPs ensure accuracy and compliance with insurance requirements [34, 57]. By leveraging machine learning techniques, these tools can flag potential errors or inconsistencies in billing documentation, reducing the risk of claim denials or delays.

**5.1.5 Ethical Considerations.** The findings suggest a growing acceptance of AI among SLPs, driven by a recognition of its potential to enhance their workflows. However, it is imperative to address ethical concerns around the integration of AI into clinical practice. These concerns arise at all stages of creation and implementation of AI solutions. First, the data and algorithms on which AI systems are built may be biased. For example, speech recognition bias is evident in automated speech recognition systems, which show less proficiency for Black adult speakers of African American English (AAE) compared to white speakers of General American English (GAE) [36]. These disparities are often more pronounced in children, who may have limited exposure to speakers outside their community and consequently display more features of their dialect

[69, 70]. Equity concerns are not unique to the work of SLPs, but are heightened because SLPs serve vulnerable populations. The use of AI to generate culturally specific material could potentially undermine efforts to increase BIPOC representation in the field of speech therapy if it perpetuates stereotypes, biases, or inaccuracies about BIPOC cultures and languages. Hence, techniques for bias mitigation, such as incorporating fairness constraints during training and using diverse datasets, are imperative. They will serve to minimize under-representation and the perpetuation of biases in AI-generated content, thereby increasing accurate representation and fostering inclusivity.

Second, it is essential to prioritize responsible AI deployment practices such as promoting transparency, accountability, and addressing privacy concerns in AI-based tools. This may include, but is not limited to, implementing robust measures to safeguard sensitive data and ensure compliance with regulations such as FERPA and HIPAA. Conducting privacy assessments of AI tools and platforms to verify their adherence to data protection standards is also crucial. Additionally, transparency regarding data collection practices and user consent mechanisms can help build trust among stakeholders. Recent research in healthcare suggests that concerns regarding the use of AI can be addressed through a combination of regulatory measures, ethical guidelines, and technological advancements. [18, 33, 48, 62]. These research can be valuable guidelines.

Finally, we need to assure that AI tools are not replacing the aspects of SLPs' jobs they find most enjoyable and meaningful, such as working with children and families, feeling a sense of growth and purpose through student success, and making meaningful connection with stakeholders. Future research is needed to foster interdisciplinary dialogue and collaboration and provide SLPs with the necessary knowledge and resources around AI. That way, we could gain a holistic understanding of the ethical implications of AI around speech-language pathology and how to leverage AI effectively while mitigating potential risks and challenges. Finally, improving the explainability and interpretability of AI-generated outputs is another important aspect. This can help SLPs understand how outputs were generated, assess their reliability, and avoid AI hallucination.

Overall, AI-based tools have the potential to assist the field of speech-language pathology by optimizing work processes and reducing the burden of non-therapy work. By leveraging AI technologies across various aspects of their practice, SLPs might be able to optimize their workflows and increase their capacity while also improving job satisfaction and professional fulfillment.

## 5.2 Design Vignettes

In our study, participants distinguished between AI technologies used for automating administrative tasks, such as documentation and scheduling, and those employed for automating interpersonal processes that foster deeper connections with clients. Participants embraced technologies that encouraged significant reductions in paperwork, streamlining their workload, and allowing them to focus more on meaningful interactions and client-centered care. On the other hand, participants voiced apprehensions about AI technologies potentially taking over their job roles. This worry centered

around the fear that increased automation, particularly in empathetic processes and interpersonal aspects of their profession, might lead to a reduced need for their unique human skills and expertise, raising concerns about the future dynamics of their roles within the field. Taking these findings into consideration, we present several design vignettes to illustrate how AI technologies might serve as a supportive tool rather than a replacement and to initiate future thinking about design in this space. We imagine:

- An AI system that analyzes session recording to create customizable reports for internal use, such as visit notes and progress reports. For example, to generate progress reports, SLPs can input baseline assessment data for each client. By analyzing the audio recordings during therapy sessions, the system distinguishes between client's speech components, such as articulation and fluency, and assigns scores to parameters defined by the SLP. The system visualizes trends and compares current performance with baseline data, continuously updating patient progress into the system. Client data is securely stored with adherence to HIPAA and FERPA protocols (related to 5.1.1 *Administrative Work*.)
- An AI system that is culturally competent and interest-driven to make speech therapy exercises engaging and personally relevant for clients. For example, if the SLP is using a story or a game that involves a meal, the system substitutes culturally relevant items based on the client's background. Instead of mentioning pasta, the story might feature rice or noodles, aligning with the client's input on cultural preferences. To make the activity more engaging, the AI system collaborates with the SLP, allowing clients to choose topics that align with their interests. Clients can select from a list of prompts related to their hobbies, favorite books, movies, or games. For instance, recognizing the client's love for Pokémon, the AI system and the SLP work together to tailor speech exercises, incorporating Pokémon characters and scenarios. Vocabulary drills could involve describing Pikachu's actions or narrating a short story involving the client's favorite Pokémon to promote engagement in exercises that may otherwise be rote and tedious (related to 5.1.2 *Session Preparation and Planning*.)
- An AI system that manages therapy scheduling and minimizes the back-and-forth communication typically involved in (re)scheduling appointments by accessing the calendars of both the SLP and the client. It considers their availability, preferred time slots, and any specific requirements for certain types of sessions. Automated reminders are sent to clients prior to their scheduled sessions to reduce the likelihood of missed appointments. Additionally, the system prompts the SLPs with reminders, ensuring they are well-prepared for each upcoming session. In the event that a client or SLP needs to reschedule, the AI system provides real-time availability updates and suggests alternative slots based on both the SLP's and the client's calendars (related to 5.1.3 *Care Coordination*.)
- An AI system that automatically verifies insurance information for each client, ensuring that billing processes align with the latest coverage details and reduces the risk of claim rejections or time spent calling insurance agencies. For example, when an

SLP completes a session, the AI system generates billing codes based on the documented services. During sessions, the system facilitates quick and accurate note-taking of the services provided and then generates a claim based on documented sessions and cross-references this information with the patient's insurance policy to optimize claims for maximum reimbursement. If the system detects possible errors or denial of insurance claims, it guides SLPs through the resolution steps (related to 5.1.4 *Billing and Insurance Management*.)

- An AI system that assists SLPs in maintaining culturally and linguistically responsive approaches during therapy sessions. For example, the AI system supports parental involvement in their child's speech therapy by translating at-home speech exercises and therapy resources into the parent's native language. This includes translations of the therapy plan, progress reports, and other educational materials. The translated materials must be reviewed by a human familiar with the language and culture (such as a cultural broker), to insure that the translation is accurate and appropriate. Corrections could be provided to help the AI system's translations improve over time (related to 5.1.5 *Ethical Considerations*.)

## 6 CONCLUSION

In this work, we explored challenges faced by Speech-Language Pathologists and their perspectives on the integration of AI technologies into their practice. This helped to identify areas where AI-based tools can offer support. Through a comprehensive and triangulated exploration of survey data, an asynchronous remote community study, and observations of online communities, we have gained insights into the challenges faced by SLPs and the potential role of AI-based tools in addressing these challenges. However, the study's focus on primarily US-based context may have limited the extrapolation of results to a larger and more diverse group. Future work could aim to address this by expanding the participant pool to include a more global perspective, especially when conducting surveys and remote ARC sessions. Our findings highlight the diverse needs and constraints of SLPs, underscoring the importance of tailored solutions to support their work. Furthermore, we identify opportunities where AI-based tools can enhance capacity and improve job satisfaction for SLPs, such as streamlining documentation, scheduling, and care coordination tasks. Future work could build on this by involving co-design efforts with SLPs to develop and refine AI prototypes tailored to their specific needs. By designing, developing, and leveraging AI technologies effectively, SLPs can optimize their workflows and enhance care quality.

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## REFERENCES

- [1] U.S. Department of Education. Individuals with Disabilities Education Act (IDEA) [n. d.]. U.S. Department of Education. Individuals with Disabilities Education Act (IDEA). Accessed: 2024-02-16.
- [2] TheraPlatform Reviews [n. d.]. *Therappractice and the shortage of speech pathologists*. TheraPlatform Reviews. Accessed: 2024-02-16.
- [3] American Psychiatry Association [n. d.]. *What is specific learning disability?* American Psychiatry Association. Accessed: 2024-02-16.
- [4] January 18, 2024. *Maximizing Speech Therapy with Artificial Intelligence*. Independently published. <https://www.amazon.com/Maximizing-Speech-Therapy-Artificial-Intelligence/dp/B0CSPB3FVL>
- [5] Kendra T Allison. 2023. From My Perspective/Opinion: Why Aren't There More BIPOC Professionals in CSD? *Leader Live* (2023).
- [6] American Speech-Language-Hearing Association. [n. d.]. *Graduate Students*. <https://www.asha.org/students/graduate-students/>
- [7] American Speech-Language-Hearing Association. 2021. *2021 Member and Affiliate Profile*. <https://www.asha.org/siteassets/surveys/2021-member-affiliate-profile.pdf>
- [8] American Speech-Language-Hearing Association. Publication year, e.g., 2022. *Audiologist and SLP to Population Ratios Report*. <https://www.asha.org/siteassets/surveys/audiologist-and-slp-to-population-ratios-report.pdf>
- [9] American Speech-Language-Hearing Association. [n. d.]. *ASHA - Employment Settings for SLPs*. <https://www.asha.org/students/employment-settings-for-slps/> Accessed: Month Day, Year.
- [10] American Speech-Language-Hearing Association. 2016. *ASHA - Code of Ethics*. <https://www.asha.org/policy/SP2016-00343/> Accessed: February 16, 2024.
- [11] Miriam Baigorri, Catherine J Crowley, Chelsea L Sommer, and Gemma Moya-Galé. 2021. Barriers and resources to cleft lip and palate speech services globally: a descriptive study. *The Journal of Craniofacial Surgery* 32, 8 (2021), 2802.
- [12] Russell W Belk. 2007. *Handbook of qualitative research methods in marketing*. Edward Elgar Publishing.
- [13] Arpita Bhattacharya, Ria Nagar, Jessica Jenness, Sean A Munson, Julie A Kientz, et al. 2021. Designing asynchronous remote support for behavioral activation in teenagers with depression: formative study. *JMIR Formative Research* 5, 7 (2021), e20969.
- [14] Zuzana Bílková, Adam Novozámský, Michal Bartoš, Adam Domíneč, Šimon Greško, Barbara Zitová, Markéta Paroubková, and Jan Flusser. 2020. Human computer interface based on tongue and lips movements and its application for speech therapy system. *Electronic Imaging* 32 (2020), 1–5.
- [15] Gordon W Blood, Jenna Swavely Ridenour, Emily A Thomas, Constance Dean Qualls, and Carol Scheffner Hammer. 2002. Predicting job satisfaction among speech-language pathologists working in public schools. (2002).
- [16] M Bok. 2015. Bicultural workplace report [Scholarly project].
- [17] David Céspedes-Hernández, Jorge Luis Pérez-Medina, Juan Manuel González-Calleros, Francisco J Álvarez Rodríguez, and Jaime Muñoz-Arteaga. 2015. Segarm: A metamodel for the design of serious games to support auditory rehabilitation. In *Proceedings of the XVI International Conference on Human Computer Interaction*. 1–8.
- [18] Yan Chen and Pouyan Esmailzadeh. 2024. Generative AI in medical practice: in-depth exploration of privacy and security challenges. *Journal of Medical Internet Research* 26 (2024), e53008.
- [19] Catherine Crowley, Miriam Baigorri, Clement Ntim, Belinda Bukari, Albert Osibagiyina, Emmanuel Kitcher, Albert Paintsil, Opoku Ware Ampomah, and Anthony Laing. 2013. Collaborations to address barriers for people with communication disabilities in Ghana: Considering the World Report on Disability. *International Journal of Speech-Language Pathology* 15, 1 (2013), 53–57.
- [20] Chinmoy Deka, Abhishek Shrivastava, Saurabh Nautiyal, and Praveen Chauhan. 2022. AI-Based Automated Speech Therapy Tools for persons with Speech Sound Disorders: A Systematic Literature Review. *arXiv preprint arXiv:2204.10325* (2022).
- [21] Giuseppe Desolda, Rosa Lanzilotti, Antonio Piccinno, and Veronica Rossano. 2021. A system to support children in speech therapies at home. In *CHIItaly 2021: 14th Biannual Conference of the Italian SIGCHI Chapter*. 1–5.
- [22] Yao Du and Felix Juefei-Xu. 2023. Generative AI for Therapy? Opportunities and Barriers for ChatGPT in Speech-Language Therapy. (2023).
- [23] Joseph R Duffy. 2016. Motor speech disorders: where will we be in 10 years?. In *Seminars in speech and language*, Vol. 37. Thieme Medical Publishers, 219–224.
- [24] Jared Duval, Zachary Rubin, Elena Márquez Segura, Natalie Friedman, Milla Zlatanov, Louise Yang, and Sri Kurniawan. 2018. Spokelt: building a mobile speech therapy experience. In *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services*. 1–12.
- [25] Debra L Edgar and Linda I Rosa-Lugo. 2007. The critical shortage of speech-language pathologists in the public school setting: Features of the work environment that affect recruitment and retention. (2007).
- [26] Rachel Endo. 2020. *Experiences of racialization in predominantly White institutions: Critical reflections on inclusion in US colleges and schools of education*. Routledge.
- [27] David W Engstrom and Jong Won Min. 2004. You just have to do a lot more for them: Perspective of bilingual social workers. *Journal of Ethnicity and Cultural Diversity in Social Work* 13, 2 (2004), 59–82.
- [28] Claire Ewen, Helen Jenkins, Craig Jackson, Jagjeet Jutley-Neilson, and John Galvin. 2021. Well-being, job satisfaction, stress and burnout in speech-language pathologists: A review. *International journal of speech-language pathology* 23, 2 (2021), 180–190.
- [29] Wiljeana Jackson Glover, Zhi Li, and Dessislava Pachamanova. 2022. The AI-enhanced future of health care administrative task management. *NEJM Catalyst Innovations in Care Delivery* 3, 2 (2022).
- [30] Howard Goode. 2015. *Solving the SLP Shortage*. Accessed: 2024-02-16.
- [31] LaVae M Hoffman, Marie Ireland, Shannon Hall-Mills, and Perry Flynn. 2013. Evidence-based speech-language pathology practices in schools: Findings from a national survey. (2013).
- [32] Nicole L Kalkhoff and Dana R Collins. 2012. Speech-language pathologist job satisfaction in school versus medical settings. (2012).
- [33] Nazish Khalid, Adnan Qayyum, Muhammad Bilal, Ala Al-Fuqaha, and Junaid Qadir. 2023. Privacy-preserving artificial intelligence in healthcare: Techniques and applications. *Computers in Biology and Medicine* (2023), 106848.
- [34] Victor Kilanko. [n. d.]. *The Transformative Potential of Artificial Intelligence in Medical Billing: A Global Perspective*. ([n. d.]).
- [35] Shamika Klassen and Casey Fiesler. 2022. "This Isn't Your Data, Friend": Black Twitter as a Case Study on Research Ethics for Public Data. *Social Media+ Society* 8, 4 (2022), 20563051221144317.
- [36] Allison Koenecke, Andrew Nam, Emily Lake, Joe Nudell, Minnie Quartey, Zion Mengesha, Connor Toups, John R Rickford, Dan Jurafsky, and Sharad Goel. 2020. Racial disparities in automated speech recognition. *Proceedings of the National Academy of Sciences* 117, 14 (2020), 7684–7689.
- [37] Robert V Kozinets. 2002. The field behind the screen: Using netnography for marketing research in online communities. *Journal of marketing research* 39, 1 (2002), 61–72.
- [38] Bridget Murray Law. 2020. *AI: A New Window Into Communication Disorders?* *Leader Live* (2020).
- [39] DonHee Lee and Seong No Yoon. 2021. Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. *International Journal of Environmental Research and Public Health* 18, 1 (2021), 271.
- [40] David Leslie. 2019. Understanding artificial intelligence ethics and safety. *arXiv preprint arXiv:1906.05684* (2019).
- [41] Ronli Levi, Ronit Ridberg, Melissa Akers, and Hilary Seligman. 2022. Survey fraud and the integrity of web-based survey research. *American Journal of Health Promotion* 36, 1 (2022), 18–20.
- [42] Haley MacLeod, Ben Jelen, Annu Prabhakar, Lora Oehlberg, Katie A Siek, and Kay Connelly. 2016. Asynchronous remote communities (ARC) for researching distributed populations. In *PervasiveHealth*. 1–8.
- [43] Leesa Marante and Kelly Farquharson. 2021. Tackling burnout in the school setting: Practical tips for school-based speech-language pathologists. *Perspectives of the ASHA Special Interest Groups* 6, 3 (2021), 665–675.
- [44] Leesa Marante, Shannon Hall-Mills, and Kelly Farquharson. 2023. School-Based Speech-Language Pathologists' Stress and Burnout: A Cross-Sectional Survey at the Height of the COVID-19 Pandemic. *Language, Speech, and Hearing Services in Schools* 54, 2 (2023), 456–471.
- [45] Rebecca Michelson, Akeiyah DeWitt, Ria Nagar, Alexis Hiniker, Jason Yip, Sean A Munson, and Julie A Kientz. 2021. Parenting in a pandemic: juggling multiple roles and managing technology use in family life during COVID-19 in the United States. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–39.
- [46] Paul L Morgan, George Farkas, Marianne M Hillemeier, Richard Mattison, Steve Maczuga, Hui Li, and Michael Cook. 2015. Minorities are disproportionately underrepresented in special education: Longitudinal evidence across five disability conditions. *Educational Researcher* 44, 5 (2015), 278–292.
- [47] Robert R Morris, Connor R Kirschbaum, and Rosalind W Picard. 2010. Broadening accessibility through special interests: a new approach for software customization. In *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*. 171–178.
- [48] Blake Murdoch. 2021. Privacy and artificial intelligence: challenges for protecting health information in a new era. *BMC Medical Ethics* 22 (2021), 1–5.

- [49] Si Ioi Ng, Dehua Tao, Jiarui Wang, Yi Jiang, Wing Yee Ng, and Tan Lee. 2018. An automated assessment tool for child speech disorders. In *2018 11th International Symposium on Chinese Spoken Language Processing (ISCSLP)*. IEEE, 493–494.
- [50] Sladjana V Nørskov, Morten Rask, et al. 2011. Observation of online communities: A discussion of online and offline observer roles in studying development, cooperation and coordination in an open source software environment. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, Vol. 12.
- [51] Teresa K O'Leary, Elizabeth Stowell, Everlyne Kimani, Dhaval Parmar, Stefan Olafsson, Jessica Hoffman, Andrea G Parker, Michael K Paasche-Orlow, and Timothy Bickmore. 2020. Community-based cultural tailoring of virtual agents. In *Proceedings of the 20th ACM International Conference on Intelligent Virtual Agents*. 1–8.
- [52] Rhea Paul. 1996. Clinical implications of the natural history of slow expressive language development. *American Journal of Speech-Language Pathology* 5, 2 (1996), 5–21.
- [53] Ariel Pomputius. 2019. Can you hear me now? Social listening as a strategy for understanding user needs. *Medical reference services quarterly* 38, 2 (2019), 181–186.
- [54] Rachel Powell. [n. d.]. *Dld in schools: An insider's perspective*. Accessed: 2024-02-16.
- [55] Pavithra Ramamurthy and Tingyu Li. 2018. Buddy: a speech therapy robot companion for children with cleft lip and palate (cl/p) disorder. In *Companion of the 2018 ACM/IEEE International Conference on Human-Robot Interaction*. 359–360.
- [56] Sandeep Reddy, John Fox, and Maulik P Purohit. 2019. Artificial intelligence-enabled healthcare delivery. *Journal of the Royal Society of Medicine* 112, 1 (2019), 22–28.
- [57] Mikko Riikinen, Hannu Saarijärvi, Peter Sarlin, and Ilkka Lähteenmäki. 2018. Using artificial intelligence to create value in insurance. *International Journal of Bank Marketing* 36, 6 (2018), 1145–1168.
- [58] Gregory C Robinson and Pamela C Norton. 2019. A decade of disproportionality: A state-level analysis of African American students enrolled in the primary disability category of speech or language impairment. *Language, Speech, and Hearing Services in Schools* 50, 2 (2019), 267–282.
- [59] V Robles-Bykbaev, M Guamán-Heredia, Y Robles-Bykbaev, J Lojano-Redrován, F Pesántez-Avilés, D Quisi-Peralta, M López-Nores, and J Pazos-Arias. 2017. Ontospeltra: A robotic assistant based on ontologies and agglomerative clustering to support speech-language therapy for children with disabilities. In *Advances in Computing: 12th Colombian Conference, CCC 2017, Cali, Colombia, September 19-22, 2017, Proceedings 12*. Springer, 343–357.
- [60] Vladimir E Robles-Bykbaev, Martín López-Nores, José J Pazos-Arias, and Daysi Arévalo-Lucero. 2015. SPELTA: An expert system to generate therapy plans for speech and language disorders. *Expert Systems with Applications* 42, 21 (2015), 7641–7651.
- [61] Konstantinos I Roumeliotis and Nikolaos D Tselikas. 2023. Chatgpt and open-ai models: A preliminary review. *Future Internet* 15, 6 (2023), 192.
- [62] Soumit Roy. 2022. PRIVACY PREVENTION OF HEALTH CARE DATA USING AI. *Journal of Data Acquisition and Processing* 37, 3 (2022), 769.
- [63] Ahmed Farag Seddik, Mohamed El Adawy, and Ahmed Ismail Shahin. 2013. A computer-aided speech disorders correction system for Arabic language. In *2013 2nd International Conference on Advances in Biomedical Engineering*. IEEE, 18–21.
- [64] Sue Sherratt. 2021. What are the implications of climate change for speech and language therapists? *International Journal of Language & Communication Disorders* 56, 1 (2021), 215–227.
- [65] Ingrid Singer, Inge S Klatte, Rosa de Vries, Remko van der Lugt, and Ellen Gerrits. 2022. Using co-design to develop a tool for shared goal-setting with parents in speech and language therapy. *International Journal of Language & Communication Disorders* 57, 6 (2022), 1281–1303.
- [66] Katie Squires. 2013. Addressing the Shortage of Speech-Language Pathologists in School Settings. *Journal of the American Academy of Special Education Professionals* 131 (2013), 137.
- [67] Dávid Sztahó, Gábor Kiss, and Klára Vicsi. 2018. Computer based speech prosody teaching system. *Computer Speech & Language* 50 (2018), 126–140.
- [68] Laura D Tyson and John Zysman. 2022. Automation, AI & work. *Daedalus* 151, 2 (2022), 256–271.
- [69] Laura Wagner, Cynthia G Clopper, and John K Pate. 2014. Children's perception of dialect variation. *Journal of child language* 41, 5 (2014), 1062–1084.
- [70] Julie A Washington, Lee Branum-Martin, Congying Sun, and Ryan Lee-James. 2018. The impact of dialect density on the growth of language and reading in African American children. *Language, speech, and hearing services in schools* 49, 2 (2018), 232–247.