Classifying Technologies during the Assessment, Treatment Planning, Documentation and Evaluation Phases of Music Therapy: A Survey of Board-Certified Practitioners

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Music therapists (MT-BCs) use diverse technologies to provide evidence-based personalized interventions to a wide variety of people. Most studies on the technological practices of MT-BCs report a general overview of the tools they use in their daily work. This study offers an new way of understanding technologies used by MT-BCs, classified and situated in the phases of music therapy (MT) practice: Assessment, Treatment Planning, In-Session, Documentation and Evaluation. An online survey was sent to a mailing list of 1,951 board-certified music therapists (MT-BC), and we received 104 responses. Results support distinct functions in technological practices between each of the phases of MT, revealing categories of notetaking and data entry that characterize planning, documentation and evaluation tasks, and a wider diversity of technology configurations in assessment and in-session work. We end by discussing design implications for HCI researchers and designers of music technologies for health, as well as HCI-MT design collaboration to better support the work of the MT-BC community.

CCS Concepts: • **Human-centered computing** → **Computer supported cooperative work**; • **General and reference** → *General conference proceedings.*

Additional Key Words and Phrases: Music Therapy, Music Therapy Technology, Assistive Technology, Music Technology, Musical Instruments, Music Therapists, Music interfaces, Technological Practices

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1 Introduction

Music has been an essential part of people's lives for centuries. As a creative art therapy (Along with visual arts, dance/movement, poetry/bibliotherapy, drama, and psychodrama therapies [50]), it actively engages people's senses, movements and feelings. Music therapy (MT) is an evidence-based approach that utilizes the elements of music and diverse musical activities [6, 46] guided by a trained professional, the music therapist. These activities include composing music, singing, listening,

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playing an instrument and discussing music[1]. Engaging in these activities leads to improvements in physical, cognitive, emotional and social wellbeing [6, 14, 15, 29].

Music therapists can treat all age groups and several health conditions, as it is often holistic and noninvasive [9], it can be utilized to treat cognitive, emotional, physical and social dimensions of the individual. For example, music therapists may use improvisation to help children improve communication, attention, motivation, and behavioral disorders [6, 28, 42]. This is also true for adults and older adults [49, 52, 53]. MT has been found to help rehabilitate speech disorders, improve breathing control and swallowing function for people with neurodegenerative diseases [51, 54]through group singing.

Throughout the MT process, music therapists utilize a wide variety of technological tools to support their practice. These technologies include musical instruments (acoustic, electric and digital) [2, 11, 39] to assess and perform interventions, health record management software [63] for documenting and quantifying progress, recording technology and others. Nonetheless, prior research has identified significant challenges for music therapists to implement technologies into their practice: Low adoption of technologies due to clinicians' lack of training , lack of access, as well as societal, environmental factors (e.g., reduced social support due to stigma on marginalized populations) [2, 35, 39]. These challenges impact music therapy research, education, and practice [9]. A more detailed understanding of the technologies used in MT, situated in the phases of practice, may help music therapists identify priority areas for training, workflow streamlining, and also help designers to propose bridging technologies that may help advance the reach and impact of current MT practice.

We set out to better understand music therapists' technological practices within an adapted framework of phases in music therapy that is widely accepted in the field: Referral, Assessment, Treatment Planning, In-session, Documentation of Progress, Evaluation and Termination of treatment [15]. An online survey was sent to board-certified music therapists (henceforth "MT-BCs") to gather information about what tools they use in each of the phases of practice, characteristics of the people they treat (known in MT and henceforth as "clients") and their perception of how their reliance on technology has changed since the COVID-19 pandemic. We found that planning, documenting and evaluation have more distinct toolkits based on common functions of notetaking and data entry, while assessment and in-session work show a wider variety in approaches and technology configurations to better suit the client and therapist.

While this classification of technology is by no means fully comprehensive, we find a promising view of the technological landscape that can help MT-BCs and HCI designers pinpoint opportunity areas of design to improve their work and cooperation amongst healthcare professionals in the context of MT. This work extends ideas of aggregating the successful practices of MT-BCs in a way that is relevant to HCI, and in a way others can learn from. This approach leverages the existing infrastructure on which current clinical collaboration occurs and may enhance the everyday work of MT-BCs and potentially other therapists alike.

2 Background and Related Work

2.1 Music Therapy and Its Benefits

Music Therapy (MT) interventions are holistic and non-invasive, which makes it an appealing and approachable treatment option for clients. The goals are individualized for most clients and can target pain relief, stress and anxiety reduction, verbal skills, emotion and socialization, resulting in physiological changes such as improved breathing control, lower blood pressure, muscle tension amongst others [15, 16, 28]. The way in which MT interventions are structured to achieve these goals

[1]Cleveland Clinic website: clevelandclinic.org

varies according to the therapist's training, toolkit and school of thought. There are numerous types of MT. Bonde and Wigram's comprehensive book identifies several MT models: Guided Imagery and Music (GIM), Analytically-Oriented Music Therapy, Creative Music Therapy (famously known as the Nordoff-Robbins method), Free Improvisation Therapy and Behavioural Music Therapy; more recently, Neurologic Music Therapy was introduced to train or rehabilitate cognitive, affective, sensory, language and motor dysfunction [6]. With this diversity of schools of thought, however, music therapists seem to follow the same structure of treatment, originally proposed by Davis and colleagues [6]. We present an adapted version of this structure with the addition of a phase which we call "In-session":

- **Referral**: The person, or "client", is sent to the music therapist when a particular condition or need is identified.
- **Assessment:** Conducted by the music therapists to understand the client's needs and capabilities to decide the best suited intervention.
- **Treatment Planning:** This phase consists of the determinations made by the music therapist, sometimes in agreement with other health professionals, around what the interventions will be and what the client's goals and clinical milestones are.
- **In-Session:** Also referred to as Implementation or Execution, it is the time when clients are engaging in the therapeutic activities in real time.
- **Documentation of Progress:** This can happen throughout the whole process. It is the qualitative and quantitative data recorded by the therapist to capture and track the client's performance and perform periodical reassessments and evaluations.
- **Evaluation:** It consists of the decision-making process to determine if the goals are being met or if modifications to the intervention are required.
- **Termination of Treatment:** This may be either the completion of the initial goals or the client's change to another form of treatment.

The American Music Therapy Association (AMTA) standards of practice are structured similarly as: Referral and Acceptance, Assessment, Treatment Planning, Implementation, Documentation and Termination[2]. We borrowed this Implementation (hereby "In-session") phase to complete our adapted phase structure.

2.2 Technology Use in Music Therapy

In recent years, the experience of music therapists and their technological practices have garnered increasing attention from researchers. Their use of technology is shaped by the goals they plan for their clients. Here, we elaborate on the state of technology in the field of MT, particularly the tools that support activities between therapist and client. We summarize what some of these latest technologies are, different classifications of these technologies in past work and technologies commonly used to manage MT practice.

Technological tools in music therapy are designed to support diverse health and work-related outcomes for both therapists and people with clinical needs. With the increasing ubiquity of mobile devices, several recent studies have reported a wide use of interactive tablet applications [48]. The tablet has been recognized as a highly impactful facilitator of the therapeutic process [34, 48]. Its capabilities afford it the versatility for accommodating many different types of apps, efficient communication and interaction between therapist and client, and the ability to integrate with other tools. Rothenberg confirms this trend in their survey study, further adding that digital audio workstations (DAWs) are commonly used by music therapists, especially GarageBand, but other examples include ABC song, Beatwave, Air Harp etc [35]. These are only one kind of apps used

[2]American Music Therapy Association (AMTA): https://www.musictherapy.org/about/standards/

amongst many others, which also highlight the importance of personalization in MT, which can solidify an experience that is both meaningful and contextually appropriate for the client [49].

Further, there has been interesting work expanding beyond traditionally-known musical instruments and mobile device apps, into alternative and multimodal interfaces. Instrumented wearable devices, like the MusiGlove have been shown to improve fine motor hand function for stroke survivors through a glove that musicalizes and gamifies gripping [21]. Another alternative interaction mode is proposed by the EyeHarp, a digital musical instrument which controls various elements of melody and harmony with the user's gaze, ideal for people with severe motor disabilities [58]. These devices and new instruments expand the scope of adaptive music technologies, as exemplified by the Modular Accessible Musical Instrument Technology Toolkit (MAMI Tech Toolkit), a co-designed system to address accessibility gaps in musicking for disabled users [60]. Several other technological use cases have been proposed to expand the applicability of music, as exemplified by Shojaei and colleagues, describing the possibilities of artificial intelligence (AI) to detect mood and behavior, applied in a therapeutic setting [49].

Technologies are also designed to administer the music therapist's work and deliver MT-specific tools. The Individualized Music Therapy Assessment Profile (IMTAP) [4] was one the first software built to assess a client's needs across multiple levels of functioning, allowing the therapist to create and customize client records to aid in clinical decision-making. While this system is still widely used, more recent tools have been put forth, such as the Music Therapy Session Assessment Scale (MT-SAS) [47] to assess the client-therapist relationship. The breadth of work in human-centered computing, personal informatics, computer-supported cooperative networks and ubiquitous technologies is ever-expanding and music-based interventions for health are within the future roadmaps of advancement of MT and technology [1].

Technologies used in an MT setting have been classified in prior research in different ways different scopes (i.e. computer-based subdivisions, physical artifacts, by methods etc). Baglione and colleagues classify them in terms of their intended function for the music therapist: Increasing efficiency, improving communication and musicking, facilitating personalized connection, promoting client identity formation, and enabling legacy preservation [2]. Other authors have described these outcomes as affordances for the client to regulate emotions, maintaining motivation and adherence, improving perceptual entrainment and motor coordination, integrate socially [1]. These categorizations are useful as functional analyses of the music therapist's toolbox, particularly, their use cases. But other classifications approximate a taxonomy of artifacts, grouping technologies by their objectual characteristics. Knight and Krout [35] define four categories of electronic music technologies: software, stand-alone products, electronic keyboard and iPads/tablets. Crowe and Rio produced a typology of seven categories: Adapted musical instruments, recording technology, electric/electronic instruments, computer applications, medical technology, assistive technology for the disabled, and technology-based music/sound healing practices [12].

An essential practice in music therapy has been telehealth, known to extend coverage of music therapy services to more distant and isolated individuals and communities [17, 59] making it more accessible to clients and reducing logistical demands on travelling therapists. Telehealth in MT has the potential to enhance self-efficacy and agency for clients, as well as acquiring transferable technological skills [8]. This is an essential consideration for understanding the current landscape of technological use in MT, but a more targeted study of technological adaptation strategies to telehealth is needed.

3 Method

An online survey was distributed to 1,952 board-certified music therapists. A total of 104 (5.32% response rate) participants responded to the survey. The survey questions covered participant

demographics, client demographics, and technological practices. In the latter, they were asked about their perceived level of reliance on technology and the tools used at each of the phases of MT outlined by Davis et al. Furthermore, it contained multiple choice questions, as well as open-ended questions. The questions covered the following topics:

- Demographic information (Gender, birthyear, ethnicity, education etc.)
- Client demographics (Client group size, health conditions commonly treated etc.)
- Contextual details on client-technology fit and telehealth.
- Technologies used in each phase of MT.

The primary author recruited participants through the Certification Board for Music Therapists (CBMT), an accredited institution which provides music therapists with the "MT-BC" credential to certify "up-to-date knowledge and competence in clinical practice"[3]. The CBMT supplied a database of 1,952 email addresses of MT-BCs, and the survey was sent to them.

Table 1. Participant Background Information

Background Information		Frequency (%)
Gender	Female	93 (89.4%)
	Male	6 (5.7%)
	Non-binary/Third Gender	2 (1.9%)
	No Response	3 (2.8%)
Ethnicity	Asian	4 (3.8%)
	Biracial or Multiracial	2 (1.9%)
	Black or African American	0
	Hispanic or Latino/a	2 (1.9%)
	Middle Eastern or North African	1 (0.9%)
	Native American or Alaskan Native	0
	White or Caucasian	94 (90.3%)
	No Response	1 (0.9%)
Educational Level	Undergraduate	55 (52.8%)
	Master's	38 (36.5%)
	Ph.D or Doctorate	5 (4.8%)
	Graduate Certificate	1 (0.9%)
	Other (e.g. Doctoral candidate)	1 (0.9%)
	No Response	4 (3.8%)
Years of Experience	1-5 years	38 (36.5%)
	6-10 years	24 (23%)
	11-15 years	8 (7.6%)
	16-19 years	7 (6.7%)
	20+ years	25 (24%)
	No Response	2 (1.9%)
Work	Full time	73 (70.1%)
	Part-time	27 (25.9%)
	No Response	4 (3.8%)

[3]CBMT website: https://www.cbmt.org/about/

As of June of 2023, the CBMT reported 10,064 total MT-BCs [4]. We discuss the relatively low response rate in our limitations.

3.1 Data Analysis

Responses were analyzed using mixed methods, to statistically describe participant's demographic information, and open ended questions regarding technology use through content analysis [36] of textual responses, where they elaborated on the many types of tools they employed in their practice. Key findings are synthesized at the end of the Findings section. Additionally, basic questions about new technologies learned and perceived level of reliance on technology at every phase of MT after the COVID-19 pandemic was announced. This question had a 4-point Likert scale, as we deemed it helpful to avoid ambiguity in the responses and potential choosing of a "safe" neutral middle answer, expressing a clearer preference that allows for easier analysis. We lastly consolidate our interpretation of the results into concise design insights for cooperative HCI design of music technologies for therapy.

3.2 Participant Demographics

Table 1 illustrates the information of participants who responded to the survey. Notably, a majority of MT-BCs was female (89%); a female majority (87%, n=600) has also been found in Hahna and colleagues' study of music therapists across the US, Canada, Australia and the UK [22], and in an international survey (81.6%, n=2495) by [32]. 90% of participants were white or Caucasian, and most participants' highest educational level attained was undergraduate degree (53%), with 37% having completed a Master's degree and 5% a PhD. Additionally, many participants had between one and five years (37%) of experience practicing music therapy, 23% had six to ten years of experience, and 24% of participants had over 20 years of experience.

These results mostly match the AMTA Workforce Analysis of 2021[5] (n=1,081), which highlights a majority female (86.44%), Caucasian/white/European (88.34%) and with most respondents having bachelors (42.94%) and master's (48.19%) degrees. This suggests our subset of MT-BCs may reflect the current state of MT practice.

4 Findings

The stages of MT proposed by Davis and colleagues serve as an adapted framework for this study to present the findings of technological practices. To recount, the original phases are Referral, Assessment, Treatment Planning, In-session, Documentation of progress, Evaluation and Termination of Treatment. This study builds on the work done by Baglione and colleagues, and as such, does not consider the phases of Referral and Termination or treatment, as these utilize technologies less specific to music therapy and more commonplace in broader healthcare settings [2]. We present client demographic data, the most prominent technological trends in each phase of MT, and lastly, some contextual information on MT technology and clients and remote work.

Following, we will key client demographic information, followed by the technologies used for each phase of MT. We identified a total number of responses (a.k.a. tools used by MT-BCs) of 132 for Assessment, 103 for Treatment Planning, 234 for In-session work, 89 for Documentation, and 93 for Evaluation. After client demographics, the key trends in each phase were ***Assessment:*** *Diversified Toolkit for "Hands-on" Work;* ***Treatment Planning:*** *Online Research, Data Entry & Note-taking;* ***In-session work:*** *Musical Interaction & Adaptive Assembly of Tools;* and lastly, ***Documentation***

[4]https://www.cbmt.org/educators/exam-and-certificant-data/

[5]https://www.musictherapy.org/assets/1/7/2021_Workforce_Analysis_final.pdf

and Evaluation: *Tools to Support Decision-Making*. We summarize the detailed findings in a table at the end of this section.

4.1 Client Demographic Information

Data about their clients was collected mainly to understand the variety of populations for whom MT-BCs flexibly adapt their treatment plans and toolkit. The multifaceted and adaptive nature of therapeutic work is reinforced by our findings around age groups (Pre-natal, Infants/Children, Pre-teen, Teens, Young adults, Adults, Mature Adults, Seniors) and diverse health conditions. The way these results match prior and concurrent research is described in the discussion. Below, we present a summary of client demographics.

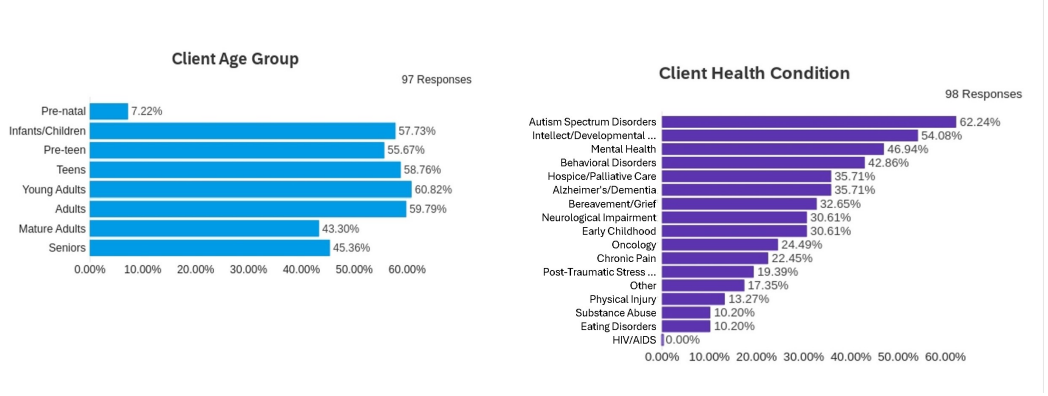

Fig. 1. Percentage of MT-BCs who work with different age groups (left) and health conditions (right).

The left-hand graphic illustrates the client age groups with which a majority of MT-BCs engage, showcasing high involvement with Young adults (60.82%), Adults (59.79%), Teens (58.76%), and Infants/Children (57.73%). This is closely trailed by Pre-teens at 55.67%. MT-BCs also work with Mature adults (43.30%) and seniors (45.36%). Notably 7.22% of participants report having worked with Pre-natal. Regarding health conditions, we see a majority of MT-BCs worked with clients with Autism Spectrum Disorder (ASD) (62.24%), Intellect/Developmental disabilities (54.08%), clients struggling with mental health (46.94%) and behavioral disorders (42.86%). About one third of MT-BCs also serve clients in hospice/palliative care (35.71%), Alzheimers and related Dementia (35.71%), and Bereavement/Grief (32.65%). Other conditions frequently served were early childhood and neurological impairments (30.61%), Oncology (24.49%), Chronic Pain (22.45%) and Post-Traumatic Stress Disorder (19.39%).

4.2 Assessment: Diversified Toolkit for "Hands-on" Work

MT-BCs reported a variety of approaches to performing assessments with their clients. We obtained 132 responses (number of tools) from all participants, which we classified into: Music Instruments (Electronic & Digital 20.2%, and Acoustic 14.4%), Tablet applications (14.4%), Note-taking, data entry & file management (Especially PDF and Word forms (10.6%)), Streaming platforms & music playback (8.7%), EMR/EHR (9.6%). Other less used tools were for Music asset management (1.9%), Recording technology (2.9%), MT Specialized software (1.9%) and Others. There remained a percentage of participants who also referred to general uses of computer (5.8%), tablet (16.3%), or provided unclear answers (13.5%).

4.2.1 Music Instruments. Therapists predominantly utilize music instruments to assess a client's capabilities before they can plan a session. Music instruments were electric, electronic or digital (20.2%), and acoustic (14.4%). Acoustic instruments can include the guitar, or handheld percussion such as tambourines. Electric, electronic and digital instruments are themselves separate categories; however, we grouped them into one, as many interfaces follow similar instrument design paradigms, for example, a keyboard is an electronic instrument which Is mimicked by many tablet apps, because of the familiar black and white keys piano interface.

4.2.2 Tablet Applications. 14.4% of participants indicated using tablet apps for assessment. 16.3% of participants mentioned using tablets, in a general sense. Notably, tablet-based applications may encompass several other categories of technology in this study, as they are often used for diverse purposes such as filling forms, taking notes, communicating, displaying imagery, searching and streaming music, amongst others. MT-BCs utilize tablets in one of these capacities for assessment, planning and implementing (in-session) their interventions. Several participants' responses to technologies used during assessment indicated tablet use in conjunction with other tools. Music instruments were widely used alongside tablet applications. For example, out findings suggested that MT-BCs can use their tablet to search for song lyrics, guitar chord charts, or piano scores, to display portably so they could then perform the music themselves or have the client play it on a musical instrument, and subsequently annotate their observations. The survey did not ask participants specifically how they utilized these technologies. However, from our data, we may infer that these tools can be employed together to systematically capture the MT-BC's observations that will inform their treatment plan. A participant described:

> *"A music therapist might use an iPad app, electronic instruments, etc. to gauge responses of clients, to present music that is better served by these music-based technology options. In addition, software/digital documentation is often used." (P26)*

4.2.3 Note-taking, data entry & file management. 10.6% of participants used tools to take notes, enter data (1%) and manage or share these files (1.9%). Participants describe such tools as Microsoft Word, Google Docs to take notes; forms like fillable PDFs, Google Forms, or Microsoft Excel to input information on the computer or tablet. File management and sharing systems like Google Drive are also used, since it is a cloud storage service in which Google Docs, Sheets, Slides are kept. These tools will be expanded upon in the following Documentation & Evaluation sections.

4.2.4 Electronic Medical/Health Records (EMR/EHR).. Participants use software to digitally manage the client's health records and enter pertinent information of the client's progress. Electronic Medical Records (EMR) are digital versions of a person's clinical chart at a healthcare facility. They contain diagnoses, treatments, test results and other clinical data generated about the client. EMR software is often utilized at large within a hospital or clinic, to improve efficiency in patient record-keeping. For MT-BCs, examples of EMR/EHR they used include EPIC software, Homecare Homebase, TheraNest and UnitusTI.

Other tools are used for assessment as well. Our results suggest a "hands-on" approach where therapists engage with the client to directly observe their capabilities and determine the appropriate musical activity. They do this by searching for specific or client-preferred music using streaming platforms (8.7%) (Such as YouTube, Spotify, or Apple Music), searching and storing song lyrics and music scores (1.9%) (Such as OnSong), or recording in a Digital Audio Workstation (DAW)(2.9%). Two MT-BCs said they used the Individualized Music Therapy Assessment Profile (IMTAP) software. Other technologies included smartwatch (0.76%) or low-tech tools like picture cards (0.76%).

4.3 Treatment Planning: Online Research, Data Entry & Note-taking

MT-BCs provided 103 responses to technologies used for planning their MT interventions. To design the most suitable activities to perform with the client, participants utilize computers (15.4%) and tablet apps (10.6%) to research and draft the intervention plan. The main trends were note-taking and data entry (19.41%), searching online resources (3.88%), music streaming (9.71%) and EMR/EHR software (7.77%). However, we found diversity in the tools utilized for planning beyond the previous categories. Other approaches included music instruments (4.85%), DAWs (3.88%), music asset management apps (4.85%), and educational content & planning software (2.91%).

4.3.1 Note-taking, data entry & online resources. We observed that participants use a variety of tools for inputting and processing data, mainly word processors (8.7%)(Microsoft Word, Excel, Google Docs), Storage and file management apps (4.8%)(Google Drive, Microsoft Teams), spreadsheets (2.9%)(Excel, Google Sheets) and presentation apps (2.9%)(Powerpoint, Google Slides), to flexibly write out and communicate a treatment plan to match the clients' goals and annotate as they go along. Additionally, several MT-BCs mentioned searching online for standardized assessment forms or reading online blogs to gather relevant information to prepare the intervention. As one participant describes, they seek to obtain "online information regarding specific diagnoses or interventions to use in session". Additionally, participants gather multimedia materials from the web. These tools include music charts (ultimate-guitar.com), lyrics (OnSong) and streaming services (YouTube, Spotify). MT-BCs also reported using music instruments (2.9%) and DAWs (3.8%), although their functionality for treatment planning remains unclear. Other tools are educational resources (2.9%) such as *teacherspayteachers.com* for accessing content, or *planbook.com* for lesson planning.

4.3.2 Music Streaming and EMR/EHR. Platforms such as Spotify, Apple Music and YouTube are used to plan sessions by looking up music to play, arrange, accompany, etc. (9.6%). EMR/EHR software (7.7%) is also used to plan treatment, by utilizing their annotation features. These two types of technologies are described in more detail in the next subsections.

4.4 In-session work: Musical Interaction & Adaptive Assembly of Tools

In this study, the In-session phase reflects the largest diversity of technologies, as we obtained 234 responses for tools utilized, which we classified into five patterns: Music instruments (42.3% electronic and digital, and 18.3% acoustic), Recording technology (21.2% DAWs, and 14.4% recording equipment), Streaming platforms & music playback (Streaming and music playback, and 5.8% sound hardware), Music asset management apps (12.5%), and Mixed media & interactive music interfaces (11.5%).

4.4.1 Music instruments. In-session work (a.k.a. "implementation") relies heavily on the use of actual music instruments with which the client can perform the activities set out by the MT-BC. Of these, 18.3% are acoustic instruments, most commonly, the guitar, and some other instruments like the Ukulele or handheld percussion. Electric, electronic & digital instruments were used by the majority of MT-BCs in-session (42.3%), where the most popular mentions were keyboards, electric guitars, and drum machines.

In this phase, we observe a wide array of technological music interfaces to suit the client's needs and capabilities. We see this in our results, where a few MT-BCs reported using controllers such as the TX16WX sampler, the Yamaha Keytar, and the Orba by Artiphon. These instruments are unique in that they depart from the "traditional" form factor of popular music instruments (e.g. The guitar, violin, piano), thus, introducing novel (and oftentimes easier) ways of performing them [28]. This affords greater accessibility for clients and have garnered increasing attention from the

MT community. These findings match prior work by Magee & Burland, whom similarly indicate that electronic musical instruments "open up new sound worlds for the client as well as offering new and adaptable ways in which they can interact with their musical environment" [41].

4.4.2 Recording technology. A salient aspect of in-session work related to capturing and storing music when it is performed. Tools used for recording consisted of digital audio workstations, or DAWs (21.2%), and recording equipment (14.4%) such as microphones and mixers. The most popular DAW was Apple's GarageBand, usually pre-installed in smartphones and tablets. It is used to access digital instruments and record with them or with externally-connected instruments of any type. This technology generates a sound file where all of the actions performed with music instruments by the client, therapist or both, are saved and stored for later playback and analysis by the therapist.

4.4.3 Streaming platforms & music playback. Importantly, many MT-BCs are able to personalize their interventions to the needs and preferences of the client because they work with "preferred music" [59], songs or pieces that the client likes, is familiar with, or chooses, and a common approach in receptive MT. 24% of MT-BCs surveyed utilize technologies for searching and playing back songs or pieces from different artists, moods or genres. The three streaming platforms used by our participants are YouTube, Spotify and Apple Music. We may speculate that this preference is due to the wealth of music libraries that these services contain, and the ease of access they afford. Additionally, 5.8% of MT-BCs reposted using sound hardware, such as bluetooth speakers, to pair together with streaming applications.

4.4.4 Music asset management apps (12.5%). These are applications where MT-BCs search for song lyrics, chord charts or music scores and store them in a virtual "song book" for easy access. The OnSong app is used by MT-BCs to create song libraries, with music and lyrics, as well as create their own songs. Other similar applications mentioned are Piascore, ForScore, and websites such as ultimate-guitar.com. These technologies are essential for the therapist, as it can be their library of curated music on which to exercise their musical skills in response to the client.

4.4.5 Mixed media & interactive music interfaces (11.5%). An interesting subset of technologies used in-session include diverse tools, both musical and non-musical, for example, products consisting of visual assets, games such as madlibs.com, or relaxation apps such as Better Sleep. Google's Chrome Music Lab is introduced here as an interactive music interface, as it presents a collection of experimental music learning tools with unconventional layouts, visual designs and interaction modes[6].

Other artifacts employed in-session were medical equipment (2.9%) such as stethoscope, educational content & planning software (2.9%), and Zoom (1.9%) for telehealth delivery.

It is important to note that these technological tools are not exclusive from one another. Participants included more than one technology in their response, which lets us consider that they utilize these tools together simultaneously, and for different purposes while conducting an MT session. One participant explained about the technologies used during a session:

> *"ALL (tools). This is highly dependent on the situation. My training as a music therapist is heavily centered on the idea of having as many resources (i.e., technologies) as possible, and adapting which ones I use in the moment to best meet my client's needs."(P9)*

Therefore, it is essential to consider that the technological practices of MT-BCs are characterized by flexibility and adaptation when musically engaged with the client.

[6]https://musiclab.chromeexperiments.com/Experiments

4.5 Documentation and Evaluation: Tools to Support Decision-Making

Documenting and evaluating progress or completion are necessary for decision-making around termination or continuation of a treatment. For this, MT-BCs aggregate notes and observations of the client's performance throughout, to assess whether they have reached the therapeutic goals. For Documentation (89 responses) and Evaluation (92 responses) phases, the two key patterns were EMR/EHR (26% in Doc., and 21.2% in Eval.) and Note-taking, data entry & file management (12.5% in Doc., and 14.4% in Eval.), which is why we grouped them. Most of these technologies were based on the desktop or laptop computer. According to literature on electronic health record (EHR) technology, note-taking is done with data that is unstructured (notes, documentation by hospital staff etc.), while data entry is more closely related to discrete, numerical or categorical data, which is structured [25]. This distinction is relevant to distinguish the different note-taking and data entry tools we have reported.

4.5.1 EMR/EHR. At the Documentation and Evaluation phases, EMR/EHR technologies are relied upon more than in the other phases of practice. EMR software are commonly provided by the health facilities to enter and manage all health information related to the clients, and thus allow for creating documentation tools to suit the therapists' needs [33, 63]. The goal of this type of software is to increase efficiency and improve coordination throughout the healthcare organization in a centralized system. We found that 26% of MT-BCs documented client progress in EMR/EHR, and 21.2% of them used these tools to evaluate. Examples of EMR software used by our participants are PowerChart, TheraNest, InSync, Epic, Homecare Homebase, and Unitus Therapy Intelligence. An important thing to consider in EMR/EHR use is that not every music therapist may use them. Some who work at clinics or private practices may purchase and provide this software, yet, this may not be the case for every music therapist. For example, some MT-BCs can continually evaluate the client's progress using music instruments (6.7%) to reassess the client's evolving skill level or rehabilitation. Table 2 shows a summary of the main categories/patterns we found from our survey results at the end of this section.

4.5.2 Note-taking, data entry & file management. MT-BCs frequently input notes about the client's performance, progress and goal completion. Primarily, MT-BCs use word processors and fillable PDFs (e.g. Microsoft Word, Google Docs) (12.5% in Doc., and 14.4% in Eval.). Secondarily, spreadsheet applications (Microsoft Excel, Google Sheets) (8.7% in Doc., and 9.6% in Eval.) and storage and sharing management systems (Microsoft SharePoint, Google Drive) (5.8% in Doc., and 3.8% in Eval.) are also used, presumably in conjunction with the former tools, as they are typically part of product suites (Google Drive, Microsoft Office). Therapists constantly take notes and enter data into fillable formats as they got through the process of assessment, planning or in-session work. There is not a single designated moment to document progress, but rather, it happens continually throughout the intervention.

4.6 Summary of Technological Trends Across MT Phases

Here, we gather the key points suggested by our findings in each phase of music therapy. These form the basis of our subsequent design-centered discussion:

- *Assessment: Diversified toolkit for "hands-on" work*, that felxibly employs musical instruments, tablet applications, notetaking and data entry tools and EMR technology.
- *Treatment Planning: Online research, data entry & note-taking* A consolidation of the therapist's assessment characterized by online resources word processors, spreadsheets, streaming platforms and EMR/EHR to define the musical interaction.

Table 2. Technology Subcategory Usage

Category	Subcategory	Assessment # (%)	Treat. Plan # (%)	In-Session # (%)	Doc. # (%)	Eval # (%)
Music Instruments	Electric, Electronic & Digital Instruments	21 (20.2%)	3 (2.9%)	44 (42.3%)	0	2 (1.9%)
	Acoustic Instruments	15 (14.4%)	2 (1.9%)	19 (18.3%)	0	5 (4.8%)
Streaming Platforms & Music Playback	Streaming Platforms & Stored Music Playback	9 (8.7%)	10 (9.6%)	25 (24.0%)	0	0
	Sound Hardware	2 (1.9%)	0	6 (5.8%)	0	0
Electronic Medical/Health Records	EMR / EHR	10 (9.6%)	8 (7.7%)	0	27 (26.0%)	22 (21.2%)
Note-taking & Data Entry products	PDF and Word forms	11 (10.6%)	9 (8.7%)	2 (1.9%)	13 (12.5%)	15 (14.4%)
	Spreadsheets	1 (1.0%)	3 (2.9%)	0	9 (8.7%)	10 (9.6%)
	Storage and File Management	2 (1.9%)	5 (4.8%)	0	6 (5.8%)	4 (3.8%)
	Presentation Apps	0	3 (2.9%)	3 (2.9%)	0	0
Recording Technology	DAWs	3 (2.9%)	4 (3.8%)	22 (21.2%)	1 (1.0%)	1 (1.0%)
	Recording Equipment & Technology	0	0	15 (14.4%)	0	0
Music Asset Management Apps	Score & Lyrics Management Apps	2 (1.9%)	5 (4.8%)	13 (12.5%)	0	0
Interactive Music Interfaces & Mixed Media	Mixed Media & Unconventional Music Instruments	0	0	12 (11.5%)	0	0
	Video	0	0	0	0	1 (1.0%)
General Tablet Use & Applications	Tablet - General	17 (16.3%)	3 (2.9%)	19 (18.3%)	3 (2.9%)	6 (5.8%)
	Tablet Apps - General	15 (14.4%)	11 (10.6)	23 (22.1%)	0	0
General Desktop / Laptop Use	Computer/Laptop - General	6 (5.8%)	16 (15.4%)	5 (4.8%)	18 (17.3%)	14 (13.5%)
MT Software	Specialized Software	2 (1.9%)	0	0	0	0
Education Software	Educational Content & Planning Software	0	3 (2.9%)	3 (2.9%)	2 (1.9%)	1 (1.0%)
Medical Devices & Sensors	Medical Equipment	0	0	3 (2.9%)	0	0
	Smartwatch	1 (1.0%)	0	0	0	0
Other	Zoom	0	0	2 (1.9%)	0	0
	Blogs	0	2 (1.9%)	0	0	0
	iPhone/iPod	0	0	5 (4.8%)	0	0
	Printed Media	1 (1.0%)	0	0	0	0
	Online Resources	0	2 (1.9%)	0	1 (1.0%)	0
Uncategorized	Unclear	14 (13.5%)	14 (13.5%)	13 (12.5%)	9 (8.7%)	11 (10.6%)
	Total number of tools	132	103	234	89	92

- *In-session: Musical interaction & adaptive assembly of tools* A dynamic process that creatively configures tools to best suit the client's needs and therapeutic goals. The key patterns are the use of diverse music instruments and recording technology, streaming platforms and music asset management (lyrics, scores), and mixed media & interactive music interfaces.
- *Documentation of Progress & Evaluation: Tools to support decision-making* Characterized by technologies used to help MT-BCs aggregate their notes and observations of the client's progress primarily through notetaking, data entry & file management applications, and EMR software. These are tools to help the therapist keep track of client's progression and make informed decisions.

4.7 Contextual Notes on Client-Technology Fit and Telehealth

To gain a clearer picture of MT technological practice, we asked participants a few questions to understand contextual aspects of their work. We inquired which tools they believe are better for individual and group therapy, which technologies they needed to learn to adapt to telehealth MT, and to rate how much they believe they rely on technology since the COVID-19 pandemic shutdown.

4.7.1 Individual & Group Technology. Our participants indicated that they work flexibly with clients one-on-one, or engaging larger groups at a time. 48.45% of our MT-BCs indicated working primarily with individual clients, while 41.24% reported working equally with individuals and groups, and 10.31% of MT-BCs indicating working solely with groups. Our participants work with groups from 2-5 people (34.31%), 6-9 people (36.27%), 10-15 people (24.51%), and 16 or more (4.9%).

Furthermore, we asked participants to list the technologies they thought best suited individual and group sessions. We found that MT-BCs primarily prefer Acoustic instruments, followed by Tablet Apps, and lastly Electric, electronic and virtual instruments. We found no differences from individual to group sessions, this hierarchy of instrument types remained almost identical. Appendix A details these results.

4.7.2 Telehealth. Participants were asked a few questions about the shift to remote MT after the COVID-19 pandemic. Only 76 MT-BCs answered these questions. Of these 76 participants, 78.95% reported not having practices MT through telehealth prior to the pandemic, where as 21.05% of them had. Then, 75% of them indicated they had to learn new technologies to keep providing MT. Most of these mentions referred to Zoom videoconferencing platform, with others using Google Meet, FaceTime, Skype. Some other tools learned were Google Classroom, and telemedicine specific software Doxy and SimplePractice.

Lastly, participants were asked how much they feel they rely on technology to do their work, before and after the COVID-19 pandemic; they rated this perception on a 4-point scale where 1 was "Do not rely at all", 2 was "somewhat rely", 3 was "regularly rely" and 4 was "fully rely" on technologies for their practice.

MT-BC responses indicated that full reliance on technology had significant increases in the assessment (14.12%), treatment planning (14.12%), in-session (25.88%) and evaluation (10.59%) phases, remaining unchanged for documentation. Inversely, our metrics of regular, somewhat and no reliance, all decreased post-pandemic. Regular reliance decreased between 2.35% and 5.88% in all phases. Somewhat reliance revealed sharper changes going into remote MT, decreasing by 12.94% in assessment, by 15.29% in treatment planning, 29.41% in in-session, 4.71% in documentation and 5.88% in evaluation. No reliance also decreased across all phases, altogether suggesting those who depended on technologies less frequently found a greater need to use them after most practices migrated into telehealth-based interventions. Appendix B shows these values in detail.

5 Discussion and Implications for HCI-MT Design

We presented our key results from our survey with 104 MT-BCs, from which we derive our following discussion and vision, situated in HCI with a lens of contributing to the cooperative work of music therapists, but also collaborating alongside HCI designers and potentially other healthcare workers. We saw overall trends in line with existing work surrounding therapist demographics and target client conditions. Our results suggested most MT-BCs work with clients with ASD, Intellectual/Developmental disorders, Mental health and behavioral disorders, which partially aligns with AMTA statistics, where the major categories of client populations served were mental health (23%), Medical/Surgical (15%) and Intellectually disabled (13%). However, the workforce analysis report shows several conditions encompassed by these three categories, which we reported separately: Intellectually Disabled includes Autism Spectrum, Intellectually/Developmentally Disabled (IDD), and Rett Syndrome; Mental Health includes Behavioral Disorder, Bereavement/Grief, Eating Disorders, Emotionally Disturbed, Forensic, Mental Health, Post Traumatic Stress Disorder, and Substance Abuse. This underlines the strides being made to develop music technologies which address these served conditions; some examples include AI music generators [62] that target exploration mental health [30], or touchscreen applications to compose music and stimulate social interactions for adolescents with ASD [24].

Our findings on technological practices across the phases of MT contribute to CSCW in four main ways: 1) Supporting and Documenting Interactive Technological Ensembles, 2) Optimize and Consolidate Repetitive Activities, 3) Expand Collaborative Training and Cooperative Know-How, and 4) Integrating with Ubiquity of Telehealth; additionally, we also consider 5) Optimizing for Tablet-centered Systems and Human Factors.

We discuss the key implications and provide specific examples of how this may be appropriated within HCI and the CSCW research community.

5.1 Supporting and Documenting Interactive Technological Ensembles - The Interactive MT Toolkit

We confirmed that the tools at the MT-BC's disposal afford a plethora of pathways toward diverse therapeutic goals. And because their multitude of technologies varied widely in assessment and in-session, we may argue that the MT-BC's artifact ecology becomes larger and versatile at times when they interact more closely with clients. In these moments of the intervention, we envision the MT-BC's practice enriched by information about the tools they use in their work, and how they may work together.

Participants consistently employ acoustic instruments (Acoustic guitar, handheld percussion, ukulele), electronic instruments (drum machine, keyboards, Artiphon Orba and Yamaha Keytar), sound equipment (mixers, recording devices), electric instruments (Electric guitar), in combination with tablet-based Digital Audio Workstations (DAWs) (GarageBand, ProTools) and Music/video streaming (YouTube, Spotify, Apple Music). These tools used in different configurations are most commonly paired or complemented with the use of the tablet, which itself may contain a wealth of digital music applications. This interplay of interactive technologies allows us to view them as rich artifact ecologies that ultimately function together [5, 31] to support the MT-BC's work. As such, we support the use of wide and adaptable MT artifact ecologies in ways that can be learned and shared. Therefore, their functions, therapeutic goals and use need to be documented for knowledge-sharing and clinical decision-making (choosing the best tools for intervention).

Scarce work of this nature has been done. Notably, Jeon, Yoon & Sohn developed a framework of recommendation for suitable technologies to create digital therapeutics (DTx) for a target disorder or disease [27]. Their approach leverages digital healthcare technology patent data, sentence analysis

and topic modeling to produce new DTx. For the context of MT, recommendations and decision points for technology use can be optimally informed by music technology characteristics that are documented, promoting a more clinically-relevant client-technology match. For example, if an unconventionally-shaped MIDI controller (e.g. Artiphon Orba) has unique potential to be played effectively by a client with cerebral palsy, then the information about its key features, therapeutic use protocols, system compatibility (Bluetooth connectivity to tablet, computer Operating System compatibility) and device interoperability, can be of tremendous value for the MT-BC's competency, coordination with other clinicians and professional community knowledge base. This approach offers promise to cross-disciplinary collaboration between HCI and MT, to generate a common discourse by breaking down music technologies into components and affordances relatable to therapeutic activities and goals.

5.2 Optimize and Consolidate Repetitive Activities

MT-BCs are required to perform a number of tasks throughout each stage of the MT process. If an EMR/EHR software is supplied by the agency, the MT-BC uses its portal to assess and document while using acoustic, electronic, and/or digital instruments, as well as gadgets and applications for recording and music streaming. During the treatment plan phase, they must also take notes. Our findings help us understand that non-musical tools are also an essential part of the process that build toward a successful intervention. We observed several use cases of data entry and note-taking tools: Microsoft products, Google Docs, Qualtrics, and EMR/EHR software are consistently used throughout assessment, planning, documentation and evaluation. These applications are housed on digital tablets and desktop or laptop computers. There are opportunities to optimize the workflows in use cases where data needs to be input digitally. Strongwater proposes the idea of organizational process consolidation through the use of worksheet tools, she affirms that "It will be advantageous for music therapists to adopt streamlined processes for recurring responsibilities such as session planning, preparation and post-session processing" [55]. Notetaking and data entry functions are repetitive, and can be consolidated and automated, not only for improving efficiency for the therapist [2], but to gain varied clinical insight analysis.

Interestingly, work has been done in this area to automate several aspects of electronic health records (EHR), spanning classification of diseases, entity recognition, and clinical notes analysis through machine learning (ML) and deep learning (DL) [25]. Although these applications are not without shortcomings, we can envision similar functions for automation in existing EMR software. Recent advances in natural language processing (NLP) have made it suitable for computers to extract information from voice and text, making it a viable option for therapists to document their insights and observations hands-free, while maintaining their engagement with the client. Live client feedback can be potentially valuable, since integrating it into institutionally-setup systems may help optimize coordination amongst MT-BCs and with other clinical staff to improve efficiency. Dihn-Le et al emphasize the potential of integrating wearable health technology with electronic health records, identifying numerous initiatives to integrate patient data [18]. However, these technologies are not without important challenges, most notably about managing confidential health information [7], complexity and density of datasets, and system compatibility. We encourage collaborative action between HCI designers, data scientists, clinicians and sound engineers to prioritize EMR/EHR integration efforts by designing for shared source format and simplicity of collected data [18]. These integrations can bring substantial contributions (methodological, outcome measures, biomarkers) to music-based intervention toolkits and clinical trials, meant to strengthen scientific rigor in which MT practice is rooted [19]. Potentially automating recurring tasks such

[7]https://www.hhs.gov/hipaa/for-professionals/privacy/index.html

as annotation throughout assessment, in-session and evaluation, can enable MT-BCs to devote more time to foster deeper client-therapist relationships [2, 44, 56], wherein MT-BCs and clients can interact more intimately in unified creative engagement, i.e. interact musically for longer, thus facilitating attainment of successful therapeutic outcomes, a central tenet in MT [8]. Optimizing informational tasks computationally may also serve the wider MT community in consolidating clinical knowledge and enable access to therapeutic insight on specially-suited music technologies, biomarkers that music technologies can support [1], and other forms of data.

5.3 Expand Collaborative Training and Cooperative Know-How

A longstanding critique of technology use in the therapeutic setting is its low uptake due to a lack of training [7, 11, 20, 38, 40–42]. While attitudes regarding adoption of new technologies vary across regions, in the United States, an increasing number of music therapists are willing to utilize new technologies [14]. The need remains to expand the technological competency of music therapists, including MT-BCs. The CBMT provides certification to music therapists based on core competencies within the six previously discussed phases, interpretation of assessment, implementation, safety, and professional development[8]. However, technological skills are not a competency significantly evaluated for certification in this organization. Our findings signaled that MT-BCs now rely more fully on technology, bringing more traction to this opportunity area.

We therefore see an opportunity to design for cooperative training in music-centered technological skills pertinent to in-session work, as technologies used here include more specialized devices such as recording technologies and mixed media and interactive music interfaces, which depart from most traditional forms of interaction common in musical training. Furthermore, non-musical technologies employed for assessment and documentation may require less additional training through EMR systems [45], and are established clinical practices in many healthcare organizations. Computer supported skill-sharing is an existing practice that on which MT-BCs can capitalize to keep their technological competencies updated. Designing online community features specific to music therapists could enable knowledge-sharing platforms where MT-BCs can access contextualized instructions on interactive music technologies and multimedia. Current technologies can be complemented by widgets or plug-ins that gather the highlights of successfully implemented novel technologies in MT into cloud-based file management systems and EMR software to crowdsource varied music technology know-how.

Interestingly, while we saw that MT-BCs work with both individuals and groups, McDermott and colleagues [43] point out that music therapists work "increasingly in systemic or ecological ways" [p.14]. This brings other clinicians, social workers, formal and informal caregivers, family and others into the therapeutic loop, which is increasingly known as "indirect" MT. For the context of this paper, skill-sharing through EMR/EHR systems can improve help streamline and enrich communications between different clinicians [23], and perhaps most importantly, help MT-BCs and music therapists of other credentials establish a technology-learning ecosystem.

5.4 Integrate with Ubiquity of Telehealth

Our participants increasingly depended on technologies as they had to provide MT remotely. This highlights the shift of MT towards having more of its activities supported by technology, particularly enabling them to deliver interventions via telehealth. This focus holds promise for the therapist's remote intervention planning capacity and client self-management strategies [1].

Telehealth-delivered music therapy is not new. It has been implemented to reach remote populations, people with limited mobility, or without reliable transportation access [8, 14, 59]. It provides

[8]CBMT Candidate Handbook: CBMT-Candidate-Handbook-2022.pdf

ease of access to both client and therapist [14]. However. it is established that lag and network instability make real-time collaboration challenging [2, 10], and there are observational limitations that prevent the therapist from accurately interpreting the client's state, and limit their ability to instruct and aid the client [61].

Therefore, accommodating increasingly ubiquitous telehealth applications is prioritized in existing work [2], and can be further adapted in EHR/EMR platforms or digital instructional technologies [13] and exploring the possibilities of remote-enabled musical instruments [26].

We emphasize the idea of adapting to the increasing ubiquity of telehealth while also designing for remote self-management of therapy through asynchronous interaction. This can be beneficial for marginalized communities, such as rural or low-income, as well as relieve logistical burdens of traveling MT-BCs. Prior work describes the significance of the latency problem [3, 57], yet, we propose to design technologies and activities based on asynchronous interaction. While not in real-time, asynchronous interaction still affords musical dialogue and promote collaboration [37]. We encourage designers and music therapists to enthusiastically explore opportunities to apply turn-based game mechanics to music technologies, as an example of remotely supervised interactions between client and therapist, as well as other design direction within the internet of musical things (IoMusT)[57].

5.5 Optimizing for tablet-centered workflow

The survey data demonstrates the potential of technology to help clients and MT-BCs with the versatility and portability the tablet provides. It can afford cross-device communication and efficiency for the therapist and interactive capabilities (e.g. touchscreen, camera) for clients. The ubiquity of tablet usage throughout all phases, although described abstractly, suggests a strong reliance on these devices to house numerous app capabilities and to function in coordination with other interfaces such as acoustic instruments, DAWs, recording equipment and even novel music interfaces such as the Orba. Categories of technology reported in our study have some overlap, as tablets commonly house tools such as note-taking and data entry, form-filling, music streaming and even interactive electronic music instruments, which is consistent with prior work examining the music therapist's technological toolkit [34, 35, 48]. Designers of music technologies should consider the potential of tablets as hubs of connectivity across music technology types as well as non-musical tools present in therapeutic work. For music therapists, tablets can be an increasingly multifunctional and capable tool as a therapeutic "co-agent" [30], to better support MT practice. The versatility of these mobile devices is a promising design direction for healthcare and music technology futures.

5.6 Summary of Design Insights

Figure 2 showcases a summary of how our design insights originated from this study's findings (left), its connecting keywords the design implications along with what this could mean for HCI and CSCW moving forward as HCI-MT design intersections.

We can observe how HCI designers and researchers can have proactive discourse with music therapists to determine suitable affordances, physical and digital features that music interfaces should possess by combining expertise. Similarly, MT-BCs may find opportunities to skill-share with other clinicians through discussing common ground of therapeutic goals and expectations and the way their institutional technologies support them. This scheme illustrated but one of many possible scenarios and frameworks that the CSCW community can appropriate and adapt to stimulate cooperative design efforts in the therapeutic sector, one we hope will see a surge in novel technologies to make MT work and people's health better.

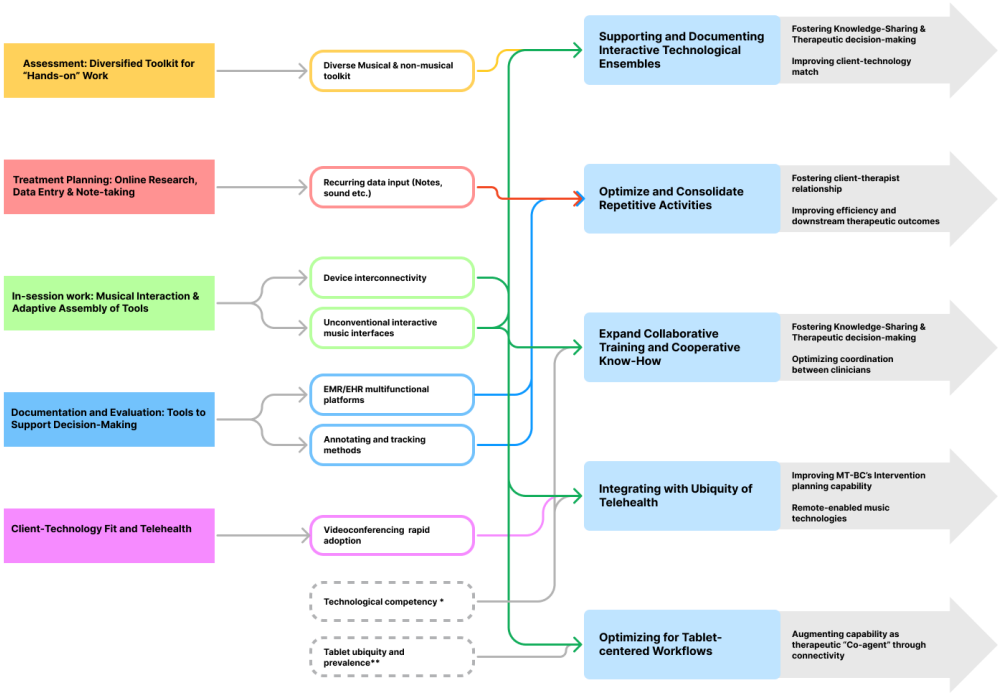

Fig. 2. HCI-MT Design Summary. * Technological competency originates from the literature and is an established challenge present at all instances of interacting with technology in the context of MT. ** Tablet ubiquity and prevalence was left separate from the findings on the left, as it is a common technology present in most phases.

6 Limitations and Future Research

We derived these insights on a broad level, with the awareness that further inquiry is needed to reconcile the following limitations in this work:

- For a survey study, our response rate was relatively low, which is why we may not accurately generalize the findings of this study to the broader MT community. We compared our demographic results to other existing work of larger scale, to attempt to validate our insights gained from this subset of the broad community.
- In a similar thread, the choice of research method limited our ability to gain detailed accounts of how MT-BCs utilize their preferred technologies, as we only collected survey data on which technologies they use. Thus, deeper explorations of user experiences and behavior (such as interviews or contextual inquiries) are needed.
- The nature of change in technological practices when migrating to telehealth fell beyond the scope of this work, even though it was minimally addressed. We only asked MT-BCs discrete queries about whether they had practiced telehealth before the pandemic, if they had to learn new technologies and which ones, and to rate how much they feel they rely on technologies before and after. Future research should examine adaptive strategies to telehealth, the impact over client-therapist relationship, and implications over MT workflow as part of a larger technological system.

We therefore believe that subsequent research could address longitudinal studies on telehealth adoption in MT with an emphasis on how their technological practices changed. CSCW research can also capitalize on our design insights to create frameworks for optimizing technology training and integration programs for MT and potentially other clinical work.

7 Conclusion

In this paper, we surveyed music therapists about their preferred technological tools used throughout Assessment, Treatment Planning, In-session, Documentation and Evaluation. Results tell us that there are clear trends and functions in different phases of MT. Note-taking and online research in Treatment planning; and note-taking, data entry and EMR/EHR logging for Documentation and Evaluation. However, practices are more diverse and flexible for Assessment and In-session work, often combining several technologies (e.g. acoustic instruments, tablet and smartphone simultaneously). From an HCI perspective, we recommend Supporting and Documenting Interactive Technological Ensembles, to Optimize and Consolidate Repetitive Activities, to Expand Collaborative Training and Cooperative Know-How, Integrating with Ubiquity of Telehealth; and Optimizing for Tablet-centered Systems and Human Factors. The design contributions we propose offer a promising view of the technological landscape that can help MT-BCs and HCI designers pinpoint opportunity areas of design to improve their work and cooperation amongst healthcare professionals in the context of MT.

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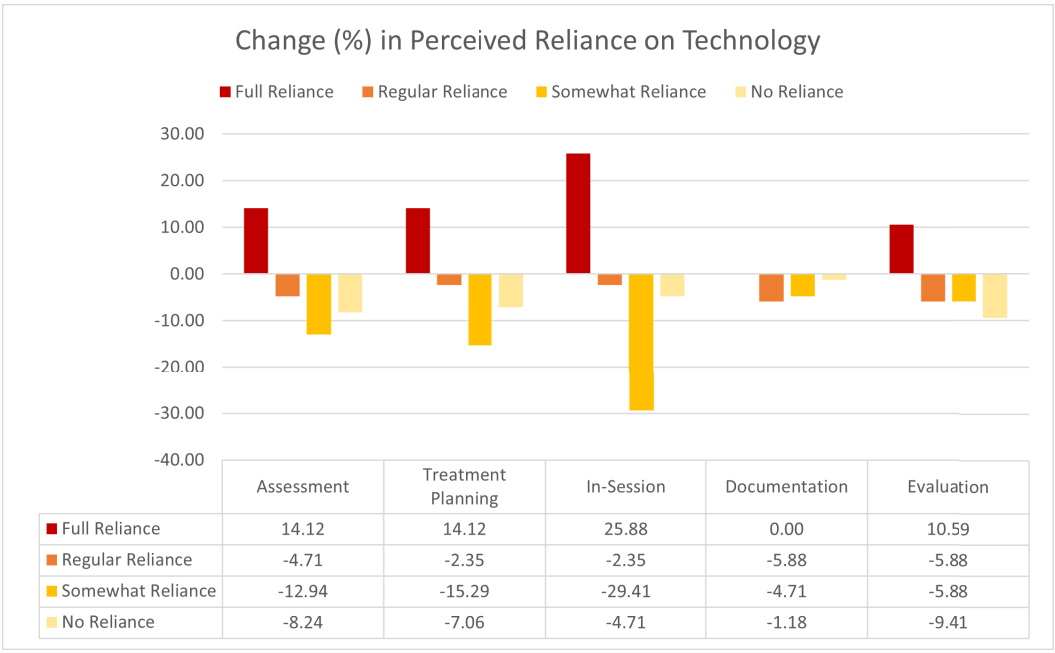
A Preferred Technologies for Individual and Group Settings

Individual Clients	**f** (%)	**Groups**	**f** (%)
Acoustic instruments	76 (21.47%)	Acoustic instruments	69 (30.53%)
Tablet Apps	72 (20.34%)	Tablet Apps	30 (13.27%)
Small Keyboards	60 (16.95%)	Electric instruments	30 (13.27%)
Virtual instruments	36 (10.17%)	Small Keyboards	29 (12.83%)
Electric instruments	36 (10.17%)	Virtual instruments	19 (8.41%)
Drum Machines	29 (8.19%)	Drum Machines	17 (7.52%)
MIDI Controllers	12 (3.39%)	Mixer	12 (5.31%)
Samplers	10 (2.82%)	Samplers	7 (3.1%)
DAWs	7 (1.98%)	MIDI Controllers	6 (2.65%)
Mixer	7 (1.98%)	DAWs	1 (0.44%)
Scratch pad	2 (0.56%)	Scratch pad	0 (0%)
Other (Please specify):	7 (1.98%)	Other (Please specify):	6 (2.65%)
Total	354 (100%)	**Total**	226 (100%)

Table 3. Considering that responses (number of tools) for individual clients were 354, and for groups there were 226, results for both categories share an almost identical hierarchy.

B Changes in Perceived Technological Reliance Before and After COVID-19 Pandemic



	Assessment	Treatment Planning	In-Session	Documentation	Evaluation
Full Reliance	14.12	14.12	25.88	0.00	10.59
Regular Reliance	-4.71	-2.35	-2.35	-5.88	-5.88
Somewhat Reliance	-12.94	-15.29	-29.41	-4.71	-5.88
No Reliance	-8.24	-7.06	-4.71	-1.18	-9.41

Fig. 3. Change in perceived reliance (%) on technologies before, and during the COVID-19 pandemic.

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