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Adapting instruments, not students: A study of adaptive musical instruments

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ADAPTING INSTRUMENTS, NOT STUDENTS

ADAPTING INSTRUMENTS, NOT STUDENTS:
A STUDY OF ADAPTIVE MUSICAL INSTRUMENTS

A Thesis Submitted
In Partial Fulfillment
Of the Requirements for the Designation
University Honors

Cheyenne Maria Chapin
University of Northern Iowa
May 2020

ADAPTING INSTRUMENTS, NOT STUDENTS

This Study by: Cheyanne Chapin

Entitled: Adapting Instruments, Not Students: A Study of Adaptive Musical Instruments

has been approved as meeting the thesis or project requirement for the Designation University Honors.

Date

Dr. Kevin Droe, Honors Thesis Advisor, School of Music

Date

Dr. Jessica Moon, Director, University Honors Program

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ADAPTING INSTRUMENTS, NOT STUDENTS

Abstract

The purposes of this study were to (1) create a categorized listing of adaptive instruments divided into categories that can help music therapists decide which clients can utilize them and for what purposes and (2) evaluate the anticipated enjoyment and sound rating of a select number of adaptive electronic instruments. For Part 1 of this study, children with special needs, with the help of their parents, were invited to take part in a questionnaire related to the impression of four select adaptive instruments (Light Block, Skoog, JamBoxx, SpecDrums). Participants were asked to watch videos of the four instruments and rate each for anticipated level of enjoyment and quality of sound. Based on the results, the participants rated the SpecDrums the highest and the Skoog the lowest. For Part 2 of this study, homemade adaptations, adaptive instruments, engineered adaptations, and apps were categorized by who can use them and how they're used. This allows music therapists to easily locate instruments that will work for their clients. Recommendations for music therapists and music educators are discussed.

Adapting Instruments, Not Students: A Study of Adaptive Musical Instruments

Introduction

The nature of music therapy creates numerous ways to help clients with various needs and demands through the use of music. According to the American Music Therapy Association, music therapy is defined as “the clinical and evidence based use of musical interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program.” Music therapy is an ever growing and changing field, adapting as new technologies become available. Because of this, music therapy is not always well understood.

In a music therapy setting, adaptive instruments are widely used to assist clients who may have differing levels of abilities such as decreased muscle control, impaired vision, diminished hearing, or loss of a limb. The federal law states that an assistive technology device is “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain or improve functional capabilities of children with disabilities” (Individuals with Disabilities Education Improvement Act of 2004). Therefore, an adaptive musical instrument would be similar with any instrument commercially produced, modified, or customized used to increase, maintain, or improve functional capabilities of children with disabilities qualifying as an adaptive musical instrument. With the wide range of adaptive instruments available to music therapists, a classification system by device type and usage could be extremely beneficial to professionals in the field and those studying it. Through this paper, we examined the techniques of music therapy and classified numerous adaptive

instruments in order to ease the process of finding an adaptive musical instrument for a client in a music therapy or music education setting.

Literature Review

Music Therapy Techniques

In order to classify how instruments can be used within a therapeutic setting, it first became important to understand the different types of music therapy techniques and practices that are available. A very common technique in music therapy is utilizing soothing, calm or positive music while focusing on one's feelings, thoughts or actions. This can be done through gentle exercise to energetic music, using specifically designed music to assist in muscle relaxation, finding positive music that can help a patient find a calm plan for when they are worked up, utilizing slow, steady music to aid in a patient falling asleep at night or drawing emotions and thoughts when listening to multiple different types of music (Hendricks, et. al., 1999). Therefore, having knowledge about a variety of instruments and how they may affect patients can assist music therapists in finding multiple ways to help patients.

Outside of listening to music, certain therapy techniques also require the individual to play music themselves rather than listen to it. Free improvisation, structured improvisation, singing familiar songs, and verbal reflection are a few of the more common playing techniques (Wigram, et. al., 2002). Furthermore, those same categories can be separated to specific technique practice as well. Improvisation can be performed with a partner, on an instrument, or by voice. Singing familiar songs can also be performed with puppets, games, or while keeping rhythm to create diversity (Gold, et. al., 2007) A categorized listing of factors such as how an instrument is played, patient muscle control, limb mobility, and cognitive challenges can help a music therapist select musical instruments that can be played by their patients. Along with

already made instruments, knowing ways to adapt instruments for their patients, such as adding an extra handle, enlarging a handle, or switching the dominant hand that plays a specific instrument gives a music therapist those extra resources to use at any time.

Categories of Adaptive Instruments

There is a generous amount of adaptive instruments that can be utilized in any setting. One category of these would be alternatively engineered musical instruments. This includes instruments that can be played with the opposite hand from normal (e.g., a trumpet played with the left hand instead of right hand), instruments reconstructed to be played with one hand instead of two, instruments reconstructed to be played with a different part of the body (e.g., a trumpet placed on a stand to be played with a foot), or utilizing a touch screen to push valves, buttons or keys on an instrument (Snedeker, 2005).

Along with engineering new ways to play existing instruments, music therapists can also create new instruments or redesign instruments to the extent needed in order to work certain muscles/movements or the clients they are serving. For a client who needed to work on muscles involved with a wrist rotation, Crowe and Ratner (2012) worked with a group of music therapists and industrial technicians who created a “twist and tune.” This instrument was played by gripping a handle and twisting it one way or another to strike various pitches (Crowe & Ratner, 2012). A client who needs to work on playing longer periods of time with their hands but may have trouble holding a drumstick might benefit from a modified drum or drumstick kit. The *Drum Buddy*, also created by a team of music therapists and industrial technicians, provided a spring loaded drumstick attached to a small frame drum that allowed the clients to be able to push the spring in a number of ways depending on their abilities (Crowe & Ratner, 2012). This

helped to increase the amount of time that clients with limited muscle movement in their arms and hands were able to play in the nursing home for this project.

Music therapists who may not have the time, budget, or resources to engineer their own modifications to instruments may benefit from select adaptive instruments that are already available. These often include electronic instruments, “sensory” instruments, or simplified instruments. The *JamBoxx* (www.jamboxx.com) allows for hands free playing by breathing into the instrument without complete hand control required. Specdrums (www.sphero.com) are light sensitive rings that can be placed on fingers or drumsticks played by touching different colors. They can be programmed to play a range of instrument sounds and pitches. Therefore, one can play on a variety of surfaces in many different settings. Instruments such as the Skoog (skoogmusic.com) or Blocks by Roli (roli.com) allow for a different kind of playing based on the touch of the instrument. These instruments have fewer buttons to think about when playing and offer a sensory touch based on how hard you push them, the material they’re made out of, and what different body parts you can play them with (Frid, 2018). These instruments and ones similar to them allow for a greater range of flexibility with the clients sensitive to touch.

Along with being able to buy instruments that are made for persons with differing abilities, music therapists can also be creative and find ways to adapt instruments themselves. This can come in many different forms. For example, if maracas or a similar instrument are hard to grip for a student or client, a music therapist could add duct tape or rubber bands to the handle to provide a more adhesive grip for their hand to hold (Judd, 2014). Problems with grip could also mean adding a new handle that is longer or wider for people with motor control. Music therapists overall will need to be able to take each of their clients where they are at and work with them from that point, looking at the positives and what they can do instead of focusing on

what they may not be capable of at the time. Being able to pull an already made instrument out, working with engineers to design and construct a personal adaptation, or making small adjustments that can be taken off when possible to make playing an instrument more feasible will all be important to any music therapist.

Purpose Statement and Research Questions

It's important for a music therapist to know what instruments are available to them. This will allow them to be able to utilize them all efficiently and be aware of the possible effects they might have on a client in any therapeutic setting. The purposes of this study were to (1) create a listing of adaptive instruments divided into categories that can help music therapists decide which clients can utilize them and for what purposes and (2) evaluate the anticipated enjoyment and sound rating of a select number of adaptive electronic instruments. For this study, the following research questions were asked:

1. Given four select adaptive instruments (Light Block, Skoog, JamBoxx, SpecDrums), which one is rated highest and lowest for anticipated enjoyment?
2. Given four select adaptive instruments (Light Block, Skoog, JamBoxx, SpecDrums), which one is rated highest and lowest for quality of sound?
3. How can adaptive musical instruments be classified by their playing demands?
4. Can adaptive musical instruments be classified by (1) who can play them, (2) how they are played, and (3) the effect they have on the client in order to help musical therapists efficiently identify possible musical instruments for clients?

Method

First, this study included a review of multiple music therapy techniques and instruments which help determine which instruments can be most appropriate in various settings. In order to classify the adaptive instruments, this study included a complete review of numerous adaptive instruments. This included researching each individual instrument for (a) price, (b) general use, (c) sound quality, and (d) perceptions of the instruments by children with special needs. All procedures were approved by the University's Institutional Review Board (Appendix A).

Second, this study used a few select instruments (Light Block, Skoog, JamBoxx, SpecDrums) that were included in an experimental questionnaire (Appendix D) to examine the impression of adaptive musical instruments. Members of the University of Northern Iowa's Spectrum Project were invited to participate (Appendix B). Parents and participants signed off on the parental consent forms and child assent forms (Appendix C). To begin the questionnaire, children with special needs were introduced to multiple instruments through a questionnaire composed of videos with users playing each instrument. After each instrument, participants rated how much fun each instrument looked to play and how much they enjoyed the sound produced by the instrument. At the very end, participants ranked each of the four instruments according to which they would most like to play. This provided information on the overall impression of the instrument. Doing this procedure with four different instruments, multiple questionnaire participants, and multiple questions on the instrument's impression solidified a lot about the effectiveness of the instruments from a viewing standpoint. A general characteristic set of each instrument was kept in a journal meticulously. Each instrument was examined for similarities and differences between these results, thus being able to classify them in such a way to group them with similar instruments containing similar effects.

Results

Of the 58 families who were emailed the questionnaire, a total of 11 participants finished the questionnaire resulting in a response rate of 19%. The participants ranged from age six to 20 with the average age of the participants being 10.9 years. Of the eleven participants, one had previously played the Light Block, one was unsure, and the rest had no experience with any of the selected instruments in this study.

Each instrument was assessed for anticipated enjoyment (i.e., how fun it looked to the participant) and sound (i.e., how much they enjoyed the sound that each instrument made) (see Table 1). After the responses were collected into a spreadsheet using Google Sheets, means and standard deviations were calculated for each instrument's anticipated enjoyment and sound (Table 1). This was calculated by adding how they rated each instrument in each category (1-5) and dividing by the number of total participants ($N = 11$).

Table 1.

Means and Standard Deviations for Anticipated Enjoyment and Sound

Instrument	Anticipated Enjoyment		Sound	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Light Block	4.55	.69	4.55	.82
Skoog	3.45	1.75	3.82	1.66
JamBoxx	4.18	1.40	4.27	1.10
SpecDrums	4.73	.65	4.82	.40

The highest rated instrument was the SpecDrums with an anticipated enjoyment rating of 4.73 and sound rating of 4.82. The second highest rated instrument was the Light Block with matching anticipated enjoyment and sound average ratings of 4.55. The third highest rated instrument was the JamBoxx with an anticipated enjoyment rating of 4.18 and sound rating of 4.27. The lowest rated instrument was the Skoog with an average anticipated enjoyment rate of 3.45 and sound rating of 3.82. Participants ranked instruments from which one they would most like to play to the one they would least like to play. The top ranked instrument was given four points and the bottom ranked instrument was given one point. Based on rankings, the SpecDrums earned a mean ranking of 3.36, followed by the Light Block with 2.91, the Skoog with 1.91, and

finally the JamBoxx with 1.82. This changed the order slightly, with the Skoog beating out the JamBoxx for third by less than a tenth of a point.

The last question of the questionnaire was related to any other instruments (electronic or acoustic) that the participants had played before the questionnaire. Of the eleven participants, three had previously played another instrument. Instruments listed in this response included: piano, electronic piano mat, cello and violin.

Discussion

Part 1: Adaptive Instrument Questionnaire

One of the purposes of this study was to evaluate the anticipated enjoyment and sound rating of a select number of adaptive electronic instruments. For this purpose, the following research questions were asked:

1. Given four select adaptive instruments (Light Block, Skoog, JamBoxx, SpecDrums), which one is rated highest and lowest for anticipated enjoyment?
2. Given four select adaptive instruments (Light Block, Skoog, JamBoxx, SpecDrums), which one is rated highest and lowest for quality of sound?

Based on the information from the questionnaire, after identifying the means for anticipated enjoyment, the SpecDrums were rated the highest and the Skoog was rated the lowest. For enjoyment of sound, the SpecDrums were again the highest and the Skoog was rated the lowest. In the videos participants viewed, the SpecDrums and Light Block were shown producing multiple sounds and capabilities while the Skoog and JamBoxx were shown only producing one sound timbre. Because of this, participants may have been swayed to rate the SpecDrums and Light Block higher for sound impression and enjoyment from seeing their

expanded capabilities. Additionally, the videos of the SpecDrums and Light Block displayed adult musicians. The Skoog video was the only one that utilized a child playing it, thus this may have impacted the participants selecting Skoog as a low ranking instrument.

Along with the helpful information gathered from this study, there are limitations as well. The biggest of these limitations was the sudden change in the experiment type. Because of a global COVID-19 pandemic, the original design of the study (children playing with instruments in person) had to be modified to an online form. The online form did not allow me to collect data on participants' initial reactions. In addition, ratings could have varied from participant to participant based on individual interpretation of what the ratings meant. Because of the newly revised IRB process approval (Appendix A) and the limited access to resources on campus, I was unable to make my own videos for the questionnaire. Due to only using videos found online, the videos within the questionnaire had many variables between them and control (e.g., same subject, same music) could not be controlled.

As the primary researcher, I thought the sounds of the Skoog and Light Block were quite similar. However, the Light Block video utilized more than one sound while the Skoog only used one sound. This may have created the larger sound rating difference between rating the Light Block ($M = 4.55$, $SD = .69$) and the Skoog ($M = 3.82$, $SD = 1.66$). If this study were to be repeated, it would be ideal to have a hands-on study. Each participant would get to enter a room with the same four selected instruments (Light Block, Skoog, JamBoxx, SpecDrums) and be allowed to play with all instruments for as long as they want within a ten minute time period. During this time, a researcher could record the frequency and duration for how long each instrument is played with.

If a questionnaire is utilized again, it would be best to have a more controlled selection of videos. More control could be introduced by having the same person playing the instruments in each video, playing each instrument to their complete capabilities and playing the same music. This will allow the participants of the questionnaire to answer based on seeing all the instruments' abilities.

Part 2: Adaptive Instrument Categorization

The second purpose of this study was to create a list of adaptive instruments divided into categories that can help music therapists decide which clients can utilize them and for what purposes. For this second purpose, the following research questions were asked:

1. How can adaptive musical instruments be classified by their playing demands?
2. Can adaptive musical instruments be classified by (1) who can play them, (2) how they are played, and (3) the effect they have on the client in order to help musical therapists efficiently identify possible musical instruments for clients?

Music therapists help clients in a number of different ways depending on their specific needs. As discussed in the literature review, many of these techniques involve listening to music while focusing on emotions (Hendricks, et. al., 1999) or playing instruments that focus on a number of different things such as rhythm, breath control, motor control, or improvisation (Wigram, et. al., 2002). Because of these specialized techniques, having a large selection of instruments complete with descriptions and similarly placed categories could save a music therapist time when selecting instruments to use in specific sessions. The following adaptive instruments, adaptations (handmade and engineered), and apps have been studied, researched,

and placed into categories based on how they are played and therefore, who can play them as well as what types of sounds they make (See Figure 1).

	Price	Homemade	Mass Produced	Individually Engineered	Electronic App	Additional Software Required
Adding Handle	< \$5.00	X				
Attaching Strap	< \$5.00	X				
Widening/Lengthening Handle	< \$5.00	X				
Extending Piano Keys	< \$5.00	X				
Texturize Piano Keys	< \$5.00	X				
Taking Strings Off Instruments	Free	X				
Tuning Strings to a Chord	Free	X				
DrumJam	\$7.99				X	
Drum Kit	Free				X	
Thumb Jam	\$8.99				X	
Keezy Drummer	Free				X	
Polyphonic	Free				X	
LoopyHD	\$4.99				X	
Orphion	\$0.99				X	
Adaptive Use Musical Instrument (AUMI)	Free				X	
JamBoxx	\$279.00		X			X
Skoog	\$200.00		X			X
Skwitch	\$50.00		X			X
SpecDrums	\$100.00		X			X
Instrument 1	\$399.00		X			X
Orba	N/A		X			X
Light Block (Seaboard)	\$650.00		X			X
Launchpad	\$199.99		X			X
Q-Chord	\$349.99		X			
Sound Beam	\$2,958.00		X			X
Mogee	\$50.00		X			X
Yubi de Piano	\$74.93		X			X
Adaptive Musical Instrument Mount	\$49.99		X			
E-Z Chord	\$23.95		X			
Velcro Grip Egg Shaker	\$8.25		X			
Adapt-A-Pick	N/A		X			
Opposite Hand Instrument	N/A			X		
Pedals to Play Instrument w/ Foot	N/A			X		
Instrument Stand for One Handed Play	N/A			X		
Aulos C Soprano 7 Piece Recorder	N/A		X			
One Handed Recorder	N/A		X	X		

Figure 1: Adaptive Instruments Categorization Chart

	-----Physical Disability-----					
	Hands Free	Gross Motor Skills	Fine Motor Skills	Cognitive Disability	Vision Loss	Hearing Loss
Adding Handle		X				
Attaching Strap	X	X				
Widening/Lengthening Handle		X				
Extending Piano Keys		X	X		X	
Texturize Piano Keys		X	X	X	X	X
Taking Strings Off Instruments		X		X		X
Tuning Strings to a Chord		X		X		X
DrumJam		X				X
Drum Kit		X				X
Thumb Jam		X				
Keezy Drummer		X		X		
Polyphonic		X		X		X
LoopyHD		X		X		X
Orphion		X		X		X
Adaptive Use Musical Instrument (AUMI)	X				X	
JamBoxx	X	X			X	
Skoog	X	X		X	X	X
Skwitch	X	X		X	X	X
SpecDrums		X	X	X		X
Instrument 1		X				
Orba		X				X
Light Block (Seaboard)	X	X				
Launchpad		X	X	X		X
Q-Chord		X	X	X		
Sound Beam	X				X	X
Mogee	X				X	
Yubi de Piano		X	X	X	X	X
Adaptive Musical Instrument Mount	X					
E-Z Chord		X		X	X	
Velcro Grip Egg Shaker	X	X				
Adapt-A-Pick		X				
Opposite Hand Instrument		X	X		X	
Pedals to Play Instrument w/ Foot	X	X			X	
Instrument Stand for One Handed Play	X	X	X		X	
Aulos C Soprano 7 Piece Recorder		X	X		X	
One Handed Recorder		X	X		X	

Figure 1: Adaptive Instruments Categorization Chart (continued)

Homemade Adaptations

For this study, I created categories from the most accessible to everyone to the more complex adaptations. The first category was homemade adaptations for instruments. This category involves multiple ways to add grip or stability to traditional instruments. First, one homemade adaptation can come from modifying or adding a handle. This can be done in any number of ways. If a handle is not on the instrument to start with, one can add a strap to wrap around the individual's hand with multiple different materials (string, velcro, etc). For an instrument such as a marimba mallet that has a handle already available, modifications for easier grip are available. This can be done by making the grip area wider or a different shape completely. Materials used for this can be simple materials such as string, Play-doh, clay, tape, or a tennis ball. By attaching these materials or wrapping them around the base of handles, they can be used to widen handles and make them easier to grip (University of Colorado Denver Center for Inclusive Design and Engineering). Therefore, instruments with homemade handles or additional grip on preexisting handles can be better used for individuals with limitations on their physical capabilities.

Similar to adapting a handle, if a client is unable to hold an instrument, homemade adaptations can be made by adding straps to various instruments. Straps can be worn in a number of ways to accommodate the physical abilities of numerous clients. Adding an X-shaped strap allows the weight of an instrument to be evenly distributed between both shoulders while a neck strap will have the weight centralized around the client's neck (University of Colorado Denver Center for Inclusive Design and Engineering). Having straps of any sort on an instrument can help relieve the pressure on a client's hands and allow them more strength to work on the fine motor skills needed for some instruments.

Along the lines of adding a handle, extending piano keys would be a homemade adaptive option for the piano. This can be done with popsicle sticks or tongue depressors to allow a greater extension of each key. Because there is a larger space to press each key, extending piano keys can be a good idea for a client with limited physical abilities. For clients with cognitive disabilities or hearing loss, color coding keys can be another easy adaptation to help them (University of Colorado Denver Center for Inclusive Design and Engineering). For clients with visual impairments, one might consider texturizing piano keys in order to assist the client in knowing which key is which.

For string instruments, there are a few homemade adaptations a music therapist can do to maximize the playing ability of their client. These can work for a client with limitations to their fine motor grip in forming chords or their cognitive ability to remember how to make certain chords. One technique to making chords easier to play would be by getting rid of strings or tuning strings to unconventional notes to create chords (University of Colorado Denver Center for Inclusive Design and Engineering). With this adaptation, however, you are limited to a few keys or chords per song. For performances, multiple instruments would be needed or additional time would be needed in between each song to retune the stringed instruments.

Apps and Software

Apps and software are another moderately accessible category of adaptive instruments for music therapists. Although some apps require certain computing platforms or devices, many are free to download on a mobile device. Starting with the most accessible apps would be free apps with no required software. Many of these apps can be as simple as a digital drum kit such as *DrumJam* or *Drum Kit*. These are drum kits that can be played or recorded freely. Other instruments can be played freely in other apps such as *ThumbJam* to the same effect as these

drum kits. Other apps such as *Keezy Drummer*, *Polyphonic*, and *Loopy HD* represent a category of apps designed to loop instruments over each other by selecting different patterns and selecting a play button to have them all start at the same time or looping them over each other. Apps such as *Orphion* are able to be manipulated to only a few notes per screen or many to make them easier to program for certain songs or clients utilizing them. *Adaptive Use Musical Instruments* (AUMI) utilizes the movement of any set object/body part to play five notes. The user must move horizontally or vertically to change notes in a stepwise manner. There are many apps in the app store available for little to no money that have the ability to play multiple instruments freely, record instrument play or songs, loop instrument tracks together, or provide background beats for live music to be played on a different instrument.

Mass Produced

Next for accessibility to music therapists would be adaptive instruments that are pre-made or invented. While some may be more expensive than others, these are available to buy already in order to be readily available for music therapy patients. Many of these seem to have been created to help individuals with physical limitations play instruments more accessibly, so we covered these first. The *JamBoxx* (Figure 2) is a breath powered MIDI controller that utilizes electronic sounds from over 25 instruments to allow its users to play hands free if the instrument is on a stand or similar to a harmonica if held in their hands. A JamBoxx can be utilized by a client with limited muscle control in their arms or a client without arms or hands, making it a useful instrument for persons with physical disabilities. The price of a JamBoxx is \$279 (2020) for the music therapy kit, making it a bit expensive for a music therapist to acquire, and it does require hookup to JamBoxx software on a Mac, Windows, or PC device (www.jamboxx.com).



Figure 2: JamBoxx

The *Skoog* fits into many of the same categories as the JamBoxx. It costs \$200 (2020) and can be connected to an iPhone, iPad, or other iOS device. The *Skoog* is a cube with textured puffy buttons on each side, allowing the user to push these buttons with any object or body part (Figure 2, right side). This allows the *Skoog* to be hands free if needed or utilized with any body part allowing it to be beneficial for a client with a physical disability. Another benefit of the *Skoog* is its connectivity with Apple Music and Spotify. It automatically tunes to songs being played through those streaming services to allow its users to play along (*Skoog Music*). This makes the instrument more accessible to those with a physical or cognitive disability.



Figure 3: Skwitch and Skoog by Skoog Music

Made from the same company as the Skoog, the Skwitch (Figure 2, left side) is a single button that produces electronic sounds of various instruments. For only \$50, this adaptive instrument connects to the Skwitch app and can also be played with any part of the body or another object. With programming, this device can be made to only play correct notes based on the song it is connected to through Apple Music or Spotify or based on a sequence programmed through the app according to a song (Skoog Music). Because of this programming, this device can also be used for persons with cognitive disabilities as well as physical.

Next in the list of adaptive musical instrument products is the SpecDrums (Figures 4 and 5). The SpecDrums turn colors into music by programming colors in the world around you (your shirt, a painting, wall colors, etc.) or the SpecDrums board with specific sounds on the SpecDrums app. For \$100.00, users can get two SpecDrums rings and a SpecDrums color board. The sounds programmed through the app are electronic instrument sounds from various

instruments. Once programmed, the user can tap on any color surface to create the programmed sound (Apple.com). Because of the color coding ability, this instrument not only becomes an adaptive instrument for persons with physical disabilities but also for persons with cognitive disabilities and hearing loss. Users are able to associate sounds with colors rather than just the sounds they hear, making it accessible to those with cognitive disabilities and hearing loss.



Figure 4: SpecDrum with color pad



Figure 5: SpecDrums by Sphero

The Instrument 1 (Figure 6) can also be used for clients with physical disabilities. For \$399.00, this instrument looks like the neck of a guitar by either strumming while holding the instrument like a guitar or setting it down and holding down the frets. Sounds can be produced by strumming, tapping, sliding, or drumming. The user has options between electronic guitar, drums, piano, and violin (Artiphon). Because of the ability to hold the instrument like a guitar or place it on a table and the choices of strumming, tapping, sliding, and drumming, this instrument can be utilized for clients with physical disabilities such as having limited muscle control or movement.



Figure 6: Instrument One by Artiphon

Orba (Figure 7) is Artiphon's newest adaptive instrument creation. The Orba is a small circular device with buttons all around the top surface for looping tracks. By pushing, tilting, and sliding fingers, the player can play and loop tracks of their own (McHeffrey, 2019). Although this new device is not available for purchase yet, it can be utilized for clients with physical disabilities because they can play it solely with their hands. No arm movement is required, making it accessible to some clients that other instruments would not work for.



Figure 7: Orba by Artiphon

Clients with physical disabilities can also utilize the Light Block by Roli (Figure 8). The Light Block is a textured block that can be hooked up to an electronic keyboard, mixing board, or additional light blocks if desired. It is compatible among Light Block devices and can be programmed through an iPad app to select over 25 electronic musical instruments. The Light Block kit with Seaboard and loop mixing deck is \$650. The cost of the Light Block by itself is \$160 (Roli Blocks, 2020). Users can play the block by applying pressure with any part of their body or another object, making it usable by individuals with physical disabilities.



Figure 8: Light Block and Seaboard Block by Roli

The Launchpad by Novation (Figure 9) is similar to the Light Blocks in design. This is an all in one looping station with 64 programmable buttons. Each button contains (or can be programmed) to have electronic bass, guitar, synthesizer, or drum loop tracks (ENovation Music). Although it is easier to push buttons with fingers due to the size of the buttons, individuals could also utilize other objects to activate the buttons or other body parts. This makes it accessible to clients with physical disabilities, however, the looping effect of the Launchpad always starts tracks at the same point and stops them together. This allows individuals with cognitive disabilities, fine motor challenges or hearing loss to also utilize this instrument.

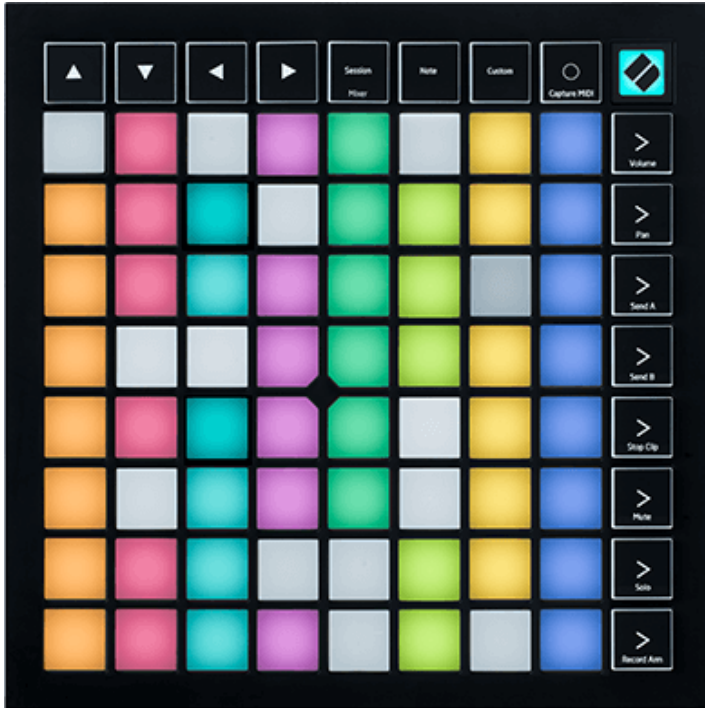


Figure 9: Launchpad by Novation

The Q-Chord (Figure 10) is composed of 36 soft touch buttons with over 100 MIDI sounds such as guitar and piano chords. Players can choose to play on their own or select accompaniment tracks by bass, drums, guitar, or piano. Priced at \$350, the Q-Chord comes with a strap to help hold up the instruments for users who opt to wear it instead of set it in front of them (Musician's Friend). Because of the multiple wearing/playing positions and numerous buttons to select from, this instrument would be appropriate for clients with physical disabilities that might affect gross motor movement without affecting fine motor movements.



Figure 10: Q-Chord by Suzuki Instruments

For other clients with potentially not as much muscle control or fine motor skills, the Sound Beam (Figure 11) can be a great option. The Sound Beam allows users to stand or sit in front of the Sound Beam and create or minimize distance between their body and the beam to change notes that the Sound Beam plays. The Sound Beam allows various electronic instruments sounds. For roughly \$2,958, the Sound Beam ships from the United Kingdom with a holder and set up (Sensory One). An instrument such as this one allows the user to focus on the large picture of making sound instead of smaller keys and buttons.



Figure 11: Sound Beam

Mogee is a vibration sensor that turns any surface into an instrument (Figure 12). By attaching the Mogee to a given surface, the user can program different sounds associated with how they hit that specific surface to create different sounds to make music with. This \$50 instrument is capable of programming various electronic instrument sounds (Mogees). Due to the various capabilities in programming and utilizing this instrument, it would be a good choice for a client with a physical disability, cognitive disability, vision loss, or even hearing loss. It requires only the use of vibrations in any capacity from hand to foot to any other body part, making it accessible for clients with physical disabilities. The use of vibrations make it an appropriate selection for a client with hearing loss who feels vibrations more intensely. A client with vision loss would not have to hit a specific part of a surface, so being able to program the instrument to play from any surface makes it adaptable to clients with vision loss.



Figure 12: Mogee

Yubi de Piano is a portable piano that you can wear on your hand. This mobile piano gives off a keyboard sound. For approximately \$75, it is possible to program the piano to only play correct pitches (Trend Hunter). With this piano attaching to a hand, Yubi de Piano can be utilized by a client with physical disabilities, vision loss, or hearing loss.



Figure 13: Yubi de Piano

Some adaptive instrument products are not instruments themselves. Instead, they are products to attach to preexisting musical instruments to make them more accessible. The Adaptive Instrument Mount made by Basic Beat allows a person who utilizes a wheelchair to attach various percussion instruments to their wheelchair. This mount allows room for two instruments to be held at the same time in order to allow a choice for the player utilizing it. These instruments can be bought alongside the mount or purchased separately and adapted to fit the mount (Special Needs Students in the General Music Classroom: Professional Development Model). For individuals unable or not wanting to hold their own instrument, this can be a good solution to keep them engaged.

Another attachment product would be a velcro grip for an egg shaker (Figure 14). Although this can be made at home as well, there is a buyable grip that can nest around two fingers or an entire hand to hold an egg shaker or other small auxiliary instrument (Special Needs Students in the General Music Classroom: Professional Development Model). This, like the adaptive instrument mount, helps those individuals that may be unable to hold an instrument so they can focus on playing instead of holding.



Figure 14: Velcro grip for egg shaker

The E-Z Chord (Figure 15) attaches to a guitar to allow the player to play chords with the push of a single button. The music therapist can color code the chord buttons on E-Z Chord in order to make it more accessible to clients with cognitive disabilities as well as physical disabilities and even those with hearing loss (Music is Elementary). Other products, like Adapt-A-Pick make playing an instrument slightly easier by adapting how you play it as well. This pick is an enlarged guitar pick texturized with fur. It engages gross motor skills instead of fine motor skills to hold (Special Needs in the General Music Classroom: Professional Development Model). The simple adaptation of enlarging a pick creates more opportunity for a client with a physical disability.



Figure 15: E-Z Chord

Individually Engineered

Unfortunately, not every adaptive instrument is easily acquired or adapted by the therapist on the spot. Some adaptations require careful planning and even the help of an engineer or instrument repair specialist to create individualized instruments for a specific client. They are not often mass produced and are created on a case by case basis. Many of these special cases were discussed in the literature review section. To highlight, “typical” musical instruments can

be engineered to only require one hand instead of two, adapted to sit on a stand so they are able to be played with a foot instead of a hand (figure 16), or re-worked to be played with the opposite hand than is normally required. This can also mean setting up an additional device such as buttons that translate to pushing down valves instead of the client pushing down the valves, which may be harder for the client to do (Snedecker, 2005).



Figure 16: Foot adaptive trumpet

There is a hybrid of engineered and buyable products that includes a one-handed recorder and seven piece recorder as well. Although these products are available, they are not as common. The Aulos C Soprano Seven Piece Recorder can be arranged in various configurations to fit any combination of six fingers between two hands. If an individual has lost any of their appendages or has better fine motor skills with specific fingers, they are able to arrange the recorder to utilize the fingers they are most confident with. After the recorder has been adapted for the individual, it is possible to glue it so it does not need to be put back together each time. The best part about this specific instrument is that it allows the individual to play alongside their peers without sticking out (Special Needs in the General Music Classroom: Professional Development Model). Along with the Aulos C Soprano Seven Piece Recorder is a one handed recorder made for individuals with loss of a limb or that can only utilize one of their hands (Figure 17) (Dolmetsch

Online). Because of the adaptations possible with these two recorders, they could certainly be utilized for clients with physical disabilities.



Figure 17: One Handed Recorder

Price Categorization

While there are many instruments that vary on which clients can use them according to their diagnoses, price can also be a large variant in purchasing these instruments as a music therapist or a parent. An instrument under \$150 would be slightly easier to save up and purchase than a much more expensive one. Therefore, these instruments can be classified by easy to acquire (less than \$150), can be acquired with some saving (moderate price \$150-\$350), or hard to acquire (very expensive \$350+). Homemade adaptations are some of the most accessible because many of them can be made with simple materials found at home such as string, tennis ball, tape, or Play-doh for handles. Extending piano keys with popsicle sticks or removing strings from an already owned instrument is relatively inexpensive as well. For buying products, the E-Z Chord can be purchased for \$24, the Mogee for \$50, the Skwitch for \$50, the Yubi de Piano for \$75, and a set of SpecDrums for \$100. This makes all of these adaptations or adaptive instruments accessible at a higher rate for a parent or therapist to purchase or do themselves.

Moderate saving or budget is needed for some of the higher priced adaptive instruments discussed. These include the Launchpad (\$200), the JamBoxx (\$279), the Skoog (\$200), and the Q-Chord (\$350). While these instruments are more expensive, they are still available to people willing/able to purchase them. Our last category of pricing involves those over \$350. This would

require a large budget to buy these instruments. This category includes the Instrument 1 for \$400, the Light Block and Seaboard pack for \$650.00, and the Sound Beam for \$2,958.00. Thus, many of these instruments are more accessible to individual families or music therapists than others.

Conclusion

The *Adaptive Instruments Questionnaire* created for this study allows educators and therapists alike to see how a select group of individuals viewed four specific instruments (Light Block, Skoog, JamBoxx, SpecDrums). Based on this study, a therapist or educator can make predictions about what instruments a student or client might like best. Although they can make an assumption, the results may show different results than their expectations, as they did for me. Thus, educators and therapists should be prepared for students and clients to not always like the instrument they predict. They then must adjust to fit the needs, interests, and abilities of the student or client to help them have the best experience possible.

Music therapists work alongside a number of different clients with a number of differing abilities. It is important for them to be able to adapt musical instruments and music instruction based on the needs and abilities of the specific client. Because of this, having a centralized list of multiple adaptive musical instruments categorized by (1) who can play them, (2) how they're played, and (3) how much they cost is a necessity. These categories allow a therapist or educator to easily see which students or clients would have access to a number of instruments. It also gives them a number of products they may not have and a description to give them an indication of whether or not they would benefit them to invest in.

Additional research for adaptive instruments should be more controlled with a broader range of capabilities shown on each instrument if given another online questionnaire. If possible,

further research would benefit from an in-person study. This would allow students to play instruments themselves. Studies should be conducted over time of several of the adaptive musical instruments discussed in this study to find where the greatest interest lies for users.

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Appendix A: IRB Approval

IRB 20-0164 - Study Approval, Expedited 7

Dear Ms. Chapin and Dr. Droe

Your study, *Adapting Instruments, Not Students: A Study of Adaptive Musical Instruments*, has been approved by the UNI IRB, under 45 CFR 46 Expedited Category 7. You may begin recruitment, data collection, and/or analysis for your project. You are required to adhere to the procedures and study materials approved during this review, as well as to follow IRB policies and procedures for human subjects research posted on the [IRB website](#).

If you need to make changes to your study design, samples, procedures, or study materials, please email the IRB Administrator at anita.gordon@uni.edu to request approval of the changes before they are implemented. Include any revised study materials with edits highlighted. You may expect a response in 2-3 days.

Your study will not require annual review and approval by the IRB. However, you will receive an **annual study update request**, which will ask if the study is still active and if any problems have arisen. *Advisors:* If your student has graduated, please reply to the annual update request on the student's behalf.

If at any time you **observe any problems** or incidents that are serious and unexpected (e.g. you did not include them in your IRB materials as a potential risk), you must **report this to the IRB** within 10 days. Examples include unexpected injury or emotional stress for study participants, missteps in the consent process, or breaches of confidentiality. The IRB will advise on any next steps that might be necessary.

If you need a signed approval letter, contact the IRB Administrator and one will be provided for your records.

Best wishes for your project success.

Mark Hecimovich, PhD

IRB Committee

Appendix B: Invitation Email

Dear Spectrum Project Parents and Guardians,

My name is Cheyanne Chapin and I'm a senior music education major at the University of Northern Iowa. As part of my senior Honors Thesis *Adapting Instruments, Not Students: A Study of Adaptive Musical Instruments*, I'm conducting a study on some select adaptive musical instruments. I have been a part of the Spectrum Project for four years now, two as a buddy and two on the movement staff. Dr. Droe is the faculty advisor for my thesis and has offered to let me reach out to all of you for your child's participation in my study.

For my study, each child will watch a set of videos on four adaptive musical instruments. They will then fill out a short questionnaire (with the help of their parents/caregivers if desired) with information on their age, favorite musical instrument from the videos, and which, if any, instruments of the ones in the videos they have used before. This will help me develop a categorized list of adaptive musical instruments for use in music therapy and music education settings according to the interest of my participants.

The link below will take you to a consent form for your child's participation in my study which includes additional information. You and your child will need to agree to the terms of the consent in order to participate. Please contact me, Cheyanne Chapin, at chapicab@uni.edu if you are interested or have further questions. Thank you for your consideration!

Link to [Adaptive Musical Instruments questionnaire](https://docs.google.com/forms/d/e/1FAIpQLSdWcEjfZ2NDGjag_dC4sDzsi2Kp0paqvjY2dpRBL5kSu-hCQg/viewform): https://docs.google.com/forms/d/e/1FAIpQLSdWcEjfZ2NDGjag_dC4sDzsi2Kp0paqvjY2dpRBL5kSu-hCQg/viewform

Best,

Cheyenne Chapin
Music Education Major

Appendix C: Parental Consent and Student Assent Form

Informed Consent Form

**UNIVERSITY OF NORTHERN IOWA
HUMAN PARTICIPANTS REVIEW
INFORMED CONSENT**

Project Title: Adapting Instruments, Not Students: A Study on Adaptive Musical Instruments

Name of Investigator(s): Cheyanne Chapin

Invitation to Participate: Your child is invited to participate in a research project on adaptive musical instruments conducted through the University of Northern Iowa. The following information is provided to help you make an informed decision about whether or not you choose to permit your child to participate.

Nature and Purpose: The purpose of this study will be to compose a listing of adaptive musical instruments divided into categories that can help music therapists decide which clients can utilize them and for what purposes. As part of this listing, we will be collecting data on the interest towards certain adaptive instruments from a number of participants based on videos of the musical instruments.

Explanation of Procedures: Students' parents/caregivers will be sent a questionnaire containing questions and videos. Students should watch the video of each instrument and select which one they would most like to play with. The additional questions on age and past experiences with these instruments should be filled out as accurately as possible as well.

Privacy and Confidentiality: Information obtained during this study which could identify your child will be kept confidential. The primary researcher and faculty advisor will know identities of participants. Collected information will be destroyed after five years. The summarized findings with no identifying information may be published in an academic journal or presented at a scholarly conference.

Discomforts, Risks, and Costs: Risks to participate are minimal. Risks to participation are similar to those experienced in day-to-day life. If participants become uncomfortable or overwhelmed, they are welcome to exit the questionnaire at any time.

Benefits and Compensation: No direct benefits to participants, but participants will get the chance to experience multiple adaptive musical instruments in the questionnaire's videos.

Right to Refuse or Withdraw: Participation is completely voluntary. You are free to withdraw your child from participation at any time or to choose not to participate at all. By doing so, you or your child will not be penalized or lose benefits to which you are both otherwise entitled.

Questions: If you have questions regarding your child's participation in this study or about the study generally, please contact Cheyanne Chapin at 641-583-3253 or Kevin Droe at the School of Music, University of Northern Iowa 319-273-3073. For answers to questions about the rights of research participants and the research review process at UNI, you may contact the office of the IRB Administrator at 319-273-6148.

Agreement:

I am fully aware of the nature and extent of my child's participation in this project as stated above and the possible risks arising from it. I hereby agree to have my child participate in this project. I acknowledge that I have received a copy of this consent statement. I am 18 years of age or older.

2. Parent Name: *

3. I agree to the conditions given to me in the above consent form and give my child permission to participate in this questionnaire. *

Mark only one oval.

Yes *Skip to question 4*

No

Participant/Child Assent Form

University of Northern Iowa Informed Assent

Project Title: Adapting Instruments, Not Students: A Study of Adaptive Musical Instruments

Name of Principal Investigator: Cheyanne Chapin

I have been told that my mom, dad, or the person who takes care of me says it is okay for me to answer questions about musical instruments. I will be watching videos of a few musical instruments and then answering questions about them.

I am doing this because I want to. I have been told that I can stop my part at any time. If I ask to stop or decide that I don't want to do this, nothing bad will happen to me.

4. Child Name: *

5. I (child) agree to the conditions given to me in the child assent form or consent form. *

Mark only one oval.

Yes *Skip to question 6*

No

Appendix D: Adaptive Instruments Question

Light Block

Light Block



<http://youtube.com/watch?v=4iHfWNrcSkc>

7. How fun does the Light Block look to play? *

Mark only one oval.

1 2 3 4 5

Not fun at all Very fun

<https://docs.google.com/forms/d/1W-MR1vtReWJFPqQeFd8IL5BvRWipR09hXhYzcWsQy0/edit>

4/6/2020

Adaptive Instruments Questionnaire

8. How much does your child enjoy the sound of the Light Block? *

Mark only one oval.

1 2 3 4 5

Not at all Very much

Skoog

Skoog



http://youtube.com/watch?v=zhQSOW4c_KY

9. How fun does the Skoog look to play? *

Mark only one oval.

	1	2	3	4	5	
Not fun at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very fun

10. How much does your child enjoy the sound of the Skoog? *

Mark only one oval.

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Jamboxx



http://youtube.com/watch?v=Ns08H_gLbfk

11. How fun does the Jamboxx look to play? *

Mark only one oval.

1 2 3 4 5

Not fun at all Very fun

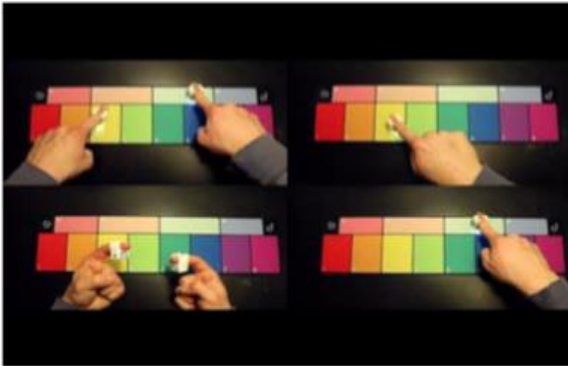
12. How much does your child enjoy the sound of the Jamboxx? *

Mark only one oval.

1 2 3 4 5

Not at all Very much

Spec Drums



<http://youtube.com/watch?v=8tLhfaeElqM>

13. How fun does Spec Drums look to play? *

Mark only one oval.

1 2 3 4 5

Not fun at all Very fun

14. How much does your child enjoy the sound of the Spec Drums? *

Mark only one oval.

1 2 3 4 5

Not at all Very much

15. Rank in order which musical instrument would be the most fun to play with. *

Mark only one oval per row.

	First Choice	Second Choice	Third Choice	Fourth Choice
Light Block	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skoob	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jamboxx	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spec Drums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Has the child played any of these instruments before? *

Check all that apply.

- Yes
 No
 Unsure

17. If yes, which instrument(s) have they experienced before this questionnaire?

Check all that apply.

- Light Block
 Skoog
 Jamboxx
 Spec Drums

18. Are there any other electronic instruments your child likes to play that are not included in this form?
