The Relationship Between Learning Persistence and Equipment Design Through the Lens

of Expectancy-Value Theory

by

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ABSTRACT

Learners' attitudes and beliefs during the initial stages of learning have a profound

impact on their future decisions, practice habits, and persistence. In music education,

however, surprisingly little research has explored how physical equipment design might

influence novices' attitudes and beliefs. The current study addresses this gap by

examining how novices' motivation and perception differ based on the physical design of

the musical instrument they interact with while learning. Fifty-two adult participants

completed an online survey measuring their expectancies (e.g., confidence), value beliefs

(e.g., enjoyment, interest, and social merit), and anticipated persistence while attempting

to learn the electric guitar. Afterward, participants attempted to learn and perform several

beginner-level tasks while using a conventionally designed or ergonomically designed

guitar. The conventionally designed guitar was a commercially available model marketed

toward beginner and intermediate-level guitarists. In contrast, the ergonomic guitar was a

custom model based on expert design recommendations to improve ease of use, comfort,

and user experience. Participant learning expectations and values were assessed before

and after a one-hour practice session. Results revealed that novices who used the

ergonomic guitar reported significant gains in anticipated learning enjoyment.

Alternatively, novices who used the conventional guitar exhibited no such change.

Beyond this relationship however, the ergonomic guitar was not found to meaningfully

affect participants' confidence, interest, physical discomfort, and task difficulty

perceptions. Additionally, the ergonomic guitar did not have a statistically significant

influence on learning persistence ratings. One important implication extracted from this

study is that a single practice session may not provide enough time or experience to affect

a novices' attitudes and beliefs toward learning. Future studies may seek to remedy this study limitation by using a longitudinal design or longer practice task trials. Despite this limitation however, this exploratory study highlights the need for researchers, music educators, and instrument manufacturers to carefully consider how the physical design of a musical instrument may impact learning attitudes, choices, and persistence over time. Additionally, this study offers the first attempt at extending the equipment design literature to music education and Expectancy-Value Theory.

DEDICATION

I dedicate this thesis to my wife and child on the way. Jamie, you gave me all that I

needed to keep going, and our child gave me every reason to get there.

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CHAPTER 1

INTRODUCTION

Individuals often perceive the challenges of learning an unfamiliar task or discipline in different ways (Davids, Buttons, & Bennett, 2008; Beltman & Volet, 2007; Boekaerts, 2006; Pitts, Davidson, & McPherson, 2000). Some find these challenges to be an enjoyable and motivating aspect of the learning process, encouraging continued effort investment and persistence. By contrast, others may perceive the same set of challenges as overwhelming, beyond their personal control, or not worth the effort and resources needed to overcome them. Not surprisingly, several studies irrespective of academic discipline, age groups, and context have illustrated that these differences in attitudes and perceptions are directly associated with persistence and quitting intentions among learners (Renshaw, Chow, Davids, & Hammond, 2010; Boekaerts, 2006). In light of these relationships, an ongoing concern throughout education research has been to identify the underlying factors that lead to the development of adaptive and maladaptive attitudes and beliefs during the learning process (Wigfield & Eccles, 2002).

Past investigations addressing these factors have suggested that Expectancy-Value Theory provides a valuable framework for evaluating how learning beliefs affect key events, such as learning outcomes, choices, and persistence (Zimmerman & Schunk, 2011, Wigfield, Tonks, & Klauda, 2009). According to theorists, these events are collectively influenced by an evaluative process in which learners implicitly or explicitly compare their task-related abilities, values, and costs beliefs against one another (Crosby, Salazar, & DiClemente, 2013; Wigfield et al., 2009; Eccles, 2005; Wigfield et al., 2002). The outcome of this evaluation provides a heuristic guideline to help learners resolve two

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fundamental questions: "am I able to do this task?" and "is it worth doing this task?" (Eccles, 2005).

Importantly however, prior research from Expectancy-Value Theory has demonstrated that learners' evaluations of their own personal abilities as well as task values and costs are highly subjective, prone to biases, and sensitive to salient affective cues (Boekaerts, 2009; Krapp, 2005). Moreover, additional research has revealed that the influence of these latter factors plays an increasingly significant role among learners with less experience in a discipline (Billeter, Kalra, & Lowenstein; 2011; Boekaerts, 2006; Kruger & Dunning, 1999). In light of these relationships, a key concern across several literature communities has been to determine how negative learning experiences and task-related costs impact learning beliefs and attitudes (Renshaw et al., 2010; Schunk & Zimmerman, 2012; Davids et al., 2008; Smith, 2007; Fredricks, Alfeld-Liro, Hruda, Eccles, Patrick, & Ryan, 2002; McPherson, 2000).

Among several of the studies addressing this concern, much attention has been directed toward understanding how task difficulty affect learning beliefs, choices, and persistence (Schunk et al., 2012). For example, Fredricks et al. (2002) found that beginner music students who perceived their discipline as excessively challenging often reported higher anxiety during performance evaluations, practiced less frequently during the week, and set lower practice goals. In addition, these students also indicated a higher intention to quit their discipline when interviewed several months afterward (Fredricks et al., 2002). Likewise, complimentary research from outside the context of education has also indicated that the experience of physical discomfort may be another cost-related factor that shapes task choices and persistence. For instance, Parfitt & Hughes (2009)

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reported that an individual's intention to repeat an effortful exercise task in the future was negatively correlated with the physical exertion and discomfort they experienced during their initial attempt at the same task.

Yet while a wealth of research has focused on the relationship between negative task factors and learning, far fewer studies have considered how these perceptions are shaped by the type of learning equipment that individuals use (Smith, 2007; Woodcock, 2007). That is, whether the physical design of the learning equipment that learners interact with may affect perceptions of personal ability, task value, and task-related costs. Among the limited number of studies investigating this relationship, a growing body of evidence from the fields of ergonomics, medicine, and sports suggests that ergonomically designed equipment can have a positive impact on key factors such as performance speed and accuracy (Buszard, Farrow, Reid, & Masters, 2014a; Tung, Shorti, Downey, Bloswick, & Merryweather, 2014) as well as reduce physical discomfort and muscle fatigue (Tung et al., 2014). However, since these studies have remained limited to the context of sports and medicine, specific demographic groups (e.g., medical students, children), and generally focus on learners with at least some prior background knowledge, it remains unclear whether similar relationships may exist in other learning contexts. Furthermore, with the exception of all but a few of these studies (e.g., Farrow & Reid, 2010; Pellett & Lox, 1998), little remains known about how these factors may affect learning motivation, task beliefs, choices, and persistence.

The present study addresses these gaps in the literature by investigating whether the physical design of learning equipment may affect novices' attitudes and beliefs within the context of music education. Specifically, this study will explore how novices'

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attitudes, beliefs, and learning outcomes may differ from one another following their initial attempt at learning with either a conventional or ergonomic designed musical instrument. This study also intends to address whether these relationships will affect novices' learning persistence following this preliminary learning experience. The following sections will review prior research central to Expectancy-Value Theory and learning persistence. Afterwards, these relationships will be explored through the lens of prior studies from the equipment design and ergonomics literature. The final section will conclude by highlighting key limitations and gaps between these research fields, and ways that the present study aims to remedy these discrepancies.

Expectancy Beliefs and Learning Persistence

Prior literature on learning persistence in disciplines such as education, music, and sports have proposed that Expectancy-Value Theory (EVT) may provide a useful lens to evaluate how learners develop adaptive or maladaptive attitudes and beliefs toward learning (Gorges & Kandler, 2012, Wigfield et al., 2009; Eccles & Wigfield, 2002). Operationally, EVT is a motivational model that compares learners' achievement-related attitudes, the perceived costs and values they associate with an activity, and the perceived likelihood of succeeding (e.g., expectancies) in this activity (Gao, Lee, Harrison, 2008). Consequently, this model under the assumption that learning effort, performance, choices, and persistence are directly related to the types of values and beliefs learners associate with an activity over time (Gao et al., 2008).

According to Wigfield et al. (2009), expectancy beliefs are comprised of two sub-categories referred to as ability beliefs and expectancies for success. Generally speaking, the former category corresponds with the learner's feelings of competence relative to a

target activity, whereas the latter category relates to how confident the learner feels that he or she will succeed in this activity in the future (Williams, 2010; Wigfield, 1994). Theorists suggest that these perceptions operate synchronously to to help learners develop a better understanding of the types of skills and knowledge they will need to perform a specific activity successfully. In music education, for instance, a musician might use cues from an unfamiliar piece of music as a relative gauge of their present knowledge and ability (e.g., competence). Content cues such as unfamiliar notation patterns, time signatures, and tempo may indicate the need for the musician to gain additional knowledge or experience before he or she can expect to understand the performance requirements. In turn, these cues help the musician determine how confident that he or she will be able to perform this piece of music (e.g., now or in the future). Due in part to this overlapping relationship between expectancy beliefs, recent findings from EVT have illustrated that capturing one dimension (e.g., confidence or competency beliefs) is often a satisfactory measure of expectancy beliefs as a whole (Durik, Shechter, Noh, Rozek, & Harackiewicz, 2015; Gao et al., 2008; Wigfield et al., 2000; Eccles, 1995).

Although the conceptual underpinnings of expectancy beliefs are straightforward, there are several experiential factors that can affect the ways expectancy beliefs are developed and expressed over time (Wigfield et al., 2009; Boekarts, 2006; Wigfield & Eccles, 2000). One factor that has received considerable attention over past decades is how expectancies are influenced by past success and failure in an activity (Pitts & McPherson, 2000). A general relationship reported throughout this literature is that continuous failures during an activity can lead to lowered expectancy beliefs among

learners, even when this activity is perceived as having high personal value or merit (Schunk, Meece, & Pintrich, 2012). Interestingly however, some research has illustrated that experience within the discipline may mediate the relationship between task failures and expectancy beliefs. That is, experienced learners often demonstrate greater resiliency and persistence when faced with failure, whereas novices tend to experience steeper declines in confidence following continued failure in a discipline or activity (Boekaerts, 2006).

One rationale for this difference is that unlike experienced learners who have several past learning experiences to draw upon when developing judgments about their abilities and knowledge in an activity, novices have inherently fewer direct experiences to reference (Pikulina, Renneboog, & Tobler, 2014). Studies looking at this relationship have routinely found that experienced learners tend to provide fairly accurate estimates of future performance outcomes in activities ranging from math (Boekaerts, 2006) to music education (McPherson, 2000). By contrast, novices and beginners are far less accurate in their predictions, in many cases exhibiting overconfidence toward their ability to learn or perform an upcoming activity (Finn & Metcalfe, 2007; Koriat, Sheffer, & Ma'ayan, 2002; Kruger & Dunning, 1999; Koriat, 1997). Interestingly however, several studies have demonstrated that the latter groups' overconfidence can quickly change to under-confidence following performance outcomes that were worse than initially anticipated (Koriat et al., 2006).

Recently, Billeter, Kalra, & Lowenstein (2011) explored this relationship over a series of learning-related experiments with groups of novice college students. In each experiment, novices attempted to learn a complex skill-based task (e.g., mirror tracing

tasks) or use a computer keyboard with an alternative key layout. In line with earlier findings (e.g., Finn et al., 2007; Koriat et al., 2002; Kruger et al., 1999), this study found that prior to attempting the performance phases of the experiment, novices routinely over-predicted how quickly and easily they would be able to learn and perform the target activities. Likewise, after failing to perform at their initially predicted level, novices' expectancies for success quickly shifted to under-confidence by the start of their second attempt. Importantly, Billeter et al. (2011) found that that it took approximately four to five trials on average until novices' expectancy beliefs increased to levels that accurately reflected their performance outcomes from trial to trial.

In respect to EVT, these collective findings may provide important insights into the ways that performance outcomes affect novices' attitudes and persistence while learning. One possibility is that unlike experienced learners, novices may be more inclined to anchor their expectancy beliefs to their initial attempts at an activity, rather than taking into account the progress they make from one attempt to the next. Thus, the greater the discrepancy between their initial expected and actual performance outcomes, the greater this anchoring effect may persist over subsequent attempts. Prior studies exploring similar explanations have revealed that the under-confidence learners experience following suboptimal performance is surprisingly resilient over short periods of time, even when learners are provided with corrective aids such as performance feedback (Koriat et al., 2002).

Importantly, while studies have shown that this over-confidence to under-confidence effect does not persist over sustained periods of time (Finn et al., 2007; Meeter & Nelson, 2003), it may still have important implications for situations in which

learners have minimal or limited opportunities to attempt an activity. For example, in disciplines such as music education and sports, resource constraints may limit the amount of time that novices get to interact with unfamiliar learning equipment (e.g., musical instruments, specialized sports equipment). Consequently, it is possible that novices with limited learning opportunities in these disciplines may not be able to experience an activity enough to progress past a state of under-confidence.

Expectancy Beliefs: Affect and Learning Persistence

A secondary aspect of EVT highlighted in the literature is that the affective responses learners experience during a previous task can meaningfully impact expectancy beliefs (Boekaerts, 2009; 2006; Eccles, 2005; Wigfield et al., 2002). Broadly speaking, affective responses to a task include a variety of emotional experiences, ranging from positive in scope (e.g., satisfaction) to negative in scope (e.g., frustration). A wealth of research on affective responses and learning has demonstrated that both the scope and intensity of past affective responses to a task can play a key role in determining the degree to which a learner is likely to repeat that task in the future (Parfitt et al., 2009).

While there are several factors that impact how learners respond emotionally to a task (e.g., locus of control, age, gender, cultural background), the influence of task difficulty and prior failures are two well investigated factors known to elicit a negative affective response (Boekaerts, 2009; 1988). For example, Turner, Thorpe, & Meyer (1998) found that students who pursued performance-oriented goals were more likely to express frustration after failing at a math task, regardless of whether the task was easy or effortful. Alternatively, students who pursued learning-oriented goals reported comparatively higher levels of pride and satisfaction (e.g., positive affective response)

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regardless of the task's outcome or effort required (Turner et al. 1998). In tandem with Schunk et al. (2012), these findings may illustrate that learners who experience frustration following failure could be more prone to lowering their learning persistence over time.

Similar relationships have been observed among novice learners beginning an unfamiliar task. Boekarts (2006) suggests that even before attempting a new task, novices develop surface-level expectancies by drawing parallels between the new task and prior tasks that entail overlapping characteristics and demands. Wigfield et al. (2000) proposes that novices go through this comparison process as a means to establish a preliminary sense of whether their present knowledge and skills (e.g., ability beliefs) will be sufficient to reach a successful outcome (e.g., expectancies for success), or whether failure is a more likely outcome.

Importantly however, findings from judgment and decision making have revealed that learners do not always remember prior task experiences with complete accuracy or detail (Finn, 2015; Finn, 2010; Kahneman, 2000). Instead, they tend to rely on specific, salient moments drawn from their memory about the past experience to guide their future decisions and expectations. For example, Finn (2010) demonstrated that novice learners participating in an English-Spanish word pairing task relied on key moments where they experienced the greatest degree of mental discomfort in past attempts when it came time to decide whether to repeat that task again in the future or not. Similarly, Kahneman, Fredrickson, Schreiber, & Redelmeier (1993) found that college students demonstrated the same decision making strategies when faced with the decision to repeat a task that involved physical discomfort. Taken together, these findings may indicate that learners

tend to overemphasize the salient moments from prior tasks to form subsequent

expectancies, even though these moments may actually account for only a small duration

of the overall task (Parfitt et al., 2009).

One major limitation with this overreliance on salient cues is that this may

increase the likelihood perceptions of past learning experiences will bias perceptions of

the similar future activities (Finn, 2015). As outlined by Healy, Kole, & Bourne (2014),

attempting a task that is too far outside the learner's zone of learnability may increase the

likelihood of leading to negative experiences such as frustration and failure. Particularly

in instances where learners lack adequate self-regulation and metacognitive strategies,

learners have a greater tendency to develop sweeping generalizations about the task as

whole (e.g., this is impossible, I will never succeed) (Boekaerts, 2006; 1988). In other

cases, learners may feel the need to reevaluate their value beliefs (discussed in the

following section) in order to compensate for the cognitive dissonance that their

frustration or failure elicits (Zimmerman et al., 2006), which in turn, may lead to negative

value judgments. Consequently, when transferring over expectancies from these tasks to

an unfamiliar task that is perceived to share several similarities, both of these biased

belief and value expectancies may promote learners to approach the novel task with less

interest, effort, and learning persistence.

Value Beliefs and Learning Persistence

Within the EVT framework, Wigfield et al. (2012) outlines four categories of task values

that learners may associate with an activity (Wigfield & Cambria, 2010). Generally

speaking, these values act as the main incentives that encourage learners to participate in

an activity (Gao et al. 2008). That is, they provide the underlying rationale for a learner to explore new activities and sustain engagement in ongoing activities.

Among the four value categories outlined in EVT, the concept of attainment value relates to the feeling of competence and personal ownership that learners perceive to come from a task (Zimmerman et al., 2011; Wigfield et al., 2010; Eccles et al., 2002). Prior studies focusing on attainment value have reported that the degree to which learners feel personally responsible for their learning outcomes may play a key role in both their expectancies and learning persistence within the learning process (Zimmerman et al., 2011; Weiner, 2010). For instance, in study discussing the factors that contribute toward music students developing expertise, Bonneville-Roussy, Lavigne, & Vallerand (2011) found that musicians who experienced high levels of personal connectedness toward their discipline and instrument set higher mastery goals, practice on a consistent basis throughout the week, and used more self-regulatory strategies while practicing in comparison to other musicians.

A second dimension of the values defined in EVT is intrinsic value (Wigfield et al., 2000). Unlike attainment value, the category of intrinsic value aligns with the immediate interest, enjoyment, or pleasure the learner anticipates to experience during the task (Wigfield et al., 2009). At a surface level, intrinsic value appears to be identical to the concept of intrinsic motivation defined in Self-Determination Theory (e.g., Ryan & Deci, 2000). However, Wigfield, Klauda, & Cambria (2011) advises that intrinsic value perceptions are context-dependent and are task-specific, whereas intrinsic motivation often pertains to the discipline as a whole (Ryan & Deci, 2000). Despite this subtle

difference however, the similarities between intrinsic value and intrinsic motivation far outweigh the differences in numerous learning contexts (Zimmerman & Schunk, 2006).

Over recent decades, numerous literature communities have demonstrated that intrinsic values have a direct influence on learning outcomes among experienced learners (Wigfield et al., 2011; Zimmerman et al., 2006). For example, Vansteenkiste, Simons, Lens, Sheldon, & Deci (2004) found that experienced students who adopted high intrinsic values toward a task demonstrated greater learning persistence and processed information more deeply in comparison to students who adopted lower intrinsic values toward the task. Additionally, Zimmerman et al. (2006) reported that students who expressed high intrinsic task values were able to transfer existing task knowledge to associated tasks with greater flexibility and seamlessness.

By comparison, contributions from Interest Theory have demonstrated that novices' intrinsic value beliefs are shaped to a greater extent by their initial experiences in a discipline (Knogler, Harackiewicz, Gegenfurtner, & Lewalter, 2015). When attempting an unfamiliar activity or discipline, novices' interest is often bound by the context and characteristics of tasks they initially encounter. According to Krapp (2005) these early experiences help novices develop a baseline form of interest referred to as situational interest. In contrast to personal interest which is described as stable, robust, and discipline-specific, situational interests are dependent on the hands-on experiences and interactions learners have in a specific task (Schraw & Lehman, 2001).

In a simple sense, these early situational interests serve as a heuristic to help determine which aspects of an activity or discipline the learner finds enjoyable or unenjoyable. Likewise, this judgment helps the learner decide which activities to invest

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his or her effort while learning, and which activities to withdraw effort. Importantly, these early impressions play a significant role in determining the types of foundational knowledge, skills, and experiences that ultimately foster the development of additional interests (Krapp, 2005). That is, the situational interest that is developed early in the learning process impacts the types of knowledge and skills that will ultimately scaffold additional interests in that discipline over time (Boekaerts, 2006; Krapp, 2002).

Boekaerts (2006) advises that one key aspect in this shift from situational to personal interest is that the learner's attention must be held long enough for him or her to experiment and explore related aspects or activities within the discipline. Thus, when novices encounter tasks that present too much initial challenge, these early interactions may offset the likelihood that they will develop the foundational knowledge and skills needed to attempt alternative areas of the discipline. Additionally, these initial challenges may also decrease the novice's expectancies and intrinsic value beliefs (Durik et al., 2015), which in turn, may diminish their persistence toward those activities in the future.

A third form of value defined in EVT is known as the utility value. Operationally, utility value parallels several characteristics of extrinsic motivation, as defined in Self-Determination Theory (Ryan et al., 2000). For instance, both constructs emphasize the potential value or reward learners may gain from a social, interpersonal, or external source (Schunk et al., 2012). While such value or rewards may be highly contextual and learner-specific, a few examples may include desirable outcomes such as acquiring prestige among peers, parental approval, or even financial gain (Ryan et al., 2000).

Prior research on utility value has shown that while external rewards are a common reason why novices pursue learning a new discipline (Costa-Giomi, 2004), it

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does not reliably predict sustained effort and persistence for the majority of novices (Schunk et al., 2012; Zimmerman, 2011; McPherson, 2000). Fredricks, Alfeld-Liro, Hruda, Eccles, Patrick, & Ryan (2002) demonstrated this point in a longitudinal study looking at adolescents' commitment within extracurricular activities such as sports and music. Fredricks et al. (2002) found that the novice music students who indicated starting the program due to social reasons (e.g., utility value), were also among the students who later reported practicing less frequently, viewed learning challenges as stressful, and experienced less emotional satisfaction from the discipline overall. When students were asked whether they believed they would to continue that discipline over subsequent years, students who indicated these latter characteristics were unsurprisingly among the students most likely to indicate an intention to quit (Fredricks et al., 2002).

Value Beliefs: Cost Perceptions and Learning Persistence

The last form of value addressed in EVT concerns the perceived costs that learners associate with a specific task. Unlike the previously discussed value perceptions which emphasize what may be potentially gained from a task, cost values relate to what learners perceive to potentially lose by participating in a task (Boekaerts, 2006). While there are several costs that learners may associate with a task (see Palmer et al., 2013; Gonzalez, Best, Healy, Kole, & Bourne, 2011; LePine, Marcie, LePine, & Jackson, 2004), the present discussion focuses on the costs associated with the perceived difficulty as well as the physical discomfort that learners may experience while attempting effortful tasks.

Prior research within the context of learning has illustrated that increases in task difficulty can have both positive and negative influences on learning outcomes and persistence. For instance, Connolly & Tenenbaum (2010) found that participants who

completed a physical rowing task during their experiment demonstrated greater attention and focus toward the task while operating at 50% power output in comparison to 30% or below. However, when operating at above 75% power output, most rowers' attention declined depending on their fitness level and gender. Connolly et al. (2010) interpreted these findings to indicate that there may be an optimal effort level (e.g., difficulty level) for people engaged in physical activities, and that this level corresponds with experiencing a desirable flow state (Csikszentmihalyi, 1990) and enjoyment.

Complementary findings have added support to this relationship in domains such as education and game-based learning (e.g., Healy, Kole, & Bourne, 2014; Healy, Wohldmann, & Bourne, 2005). For example, Vygotsky (1978) suggests that the optimal degree of task difficulty occurs within a learner's zone of proximal development -- an approximation of what knowledge or skills a learner is capable of learning with and without minimal assistance. More recently, Gee (2005) advises that learning challenges should be "pleasantly frustrating". That is, tasks should be difficult enough to challenge a learner's present abilities, but not too difficult that they are discouraged from continuing that task when failure occurs.

However, achieving an optimal level of task difficulty is a challenge in itself for both experienced and novice learners (Davids et al., 2008). Learners must not only take into account their present knowledge and skills, but also the availability of essential task resources, potential task demands, and characteristics of the learning environment (Renshaw et al., 2010; Woodcock, 2007). As a result of these complex factors and relationships, it is perhaps unsurprising that learners often pursue tasks that fall outside

(e.g., below or above) their optimal range of difficulty over the course the learning process.

In contrast to tasks that afford an optimal degree of difficulty, tasks that present too little challenge have been found to negatively impact learning outcomes and persistence (Zimmerman, 2008; Boekaerts, 1999). Boekaerts (2006) proposes that overcoming challenges and demonstrating competency (e.g., expectancy beliefs) are important experiences for many learners. Consequently, when tasks do not present enough challenge, learners are likely to withdraw effort due to their lowered enjoyment (e.g., intrinsic value) and negative affective responses stemming from their boredom (Boekaerts, 2006). Under these circumstances, learning persistence has been demonstrated to decrease due to learners' diminished value perceptions, despite their expectancy beliefs remaining consistent or even increasing over time (Boekaerts, 1999).

On the contrary, learners who are confronted with tasks that are too difficult may experience reductions in learning persistence for opposite reasons. Not surprisingly, increases in task difficulty are intuitively linked to an increased likelihood of experiencing failure; as task difficulty increases, so too does the possibility of failure. Less intuitively however, when a task is overly challenging and leads to failure, prior research reveals that learners are more likely to lower their expectancies as well as value perceptions of that task in an attempt to restore their personal well-being and feelings of competency (Boekaerts, 2006). Thus, in contrast to the route that decreased learning persistence operates through low task difficulty (e.g., low value, high expectancy), high task difficulty may lead to the opposite outcome (e.g., high value, low expectancy).

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This latter point is of particular importance when considering that novice learners often perceive a greater degree of task difficulty during the initial stages of knowledge or skill acquisition (Dreyfus, 2004). While there are several models of skill acquisition (e.g., Dreyfus, 2004; Alexander, 2003; Ackerman, 1988; Anderson, 1982; Fitts & Posner, 1967), these models generally agree that novice learners progress through a series of different stages while learning. Among these stages however, the preliminary stage may be considered a testing bed for learning persistence since novices may struggle to acclimate to the initial cognitive or physical demands of a task or discipline (Alexander, 2003). As novices attempt to orient themselves to a host of task or discipline-specific concepts, rules, and relationships, much of this information is initially processed at a highly conscious level (Dreyfus, 2003). Especially among disciplines that have a steep initial learning curve, it may take several attempts at a task before novices can begin to apply this recently acquired information with less conscious direction and greater automaticity (Dreyfus, 2003).

In comparison to the considerable amount of research addressing the costs associated with perceived task difficulty, no known research from educational psychology has specifically addressed how experiencing physical discomfort during learning may influence cost perceptions. Despite this vacancy in the literature however, several communities from outside the context of education, such as judgment and decision making, may provide valuable insights into potential relationships. For example, one relationship found within the judgment and decision making literature is that people recall the intensity and experience of physical discomfort differently as time progresses

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from the moment at which the painful event occurred (Fredrickson, 2000; Redelmeier & Kahneman, 1996).

Stone, Broderick, Schwartz, Shiffman, Litcher-Kelly, & Calvanese (2003) illustrated this relationship in a study looking at how chronic pain patients evaluated their pain intensity on both electronic diary entries and end-of-day recall responses. The findings from Stone et al. (2003) indicated that patients routinely reported lower levels of pain intensity on momentary measures, while reporting higher levels of pain intensity on end-of-day recall measures. In the past, a common explanation for this discrepancy between momentary measures and end-of-day measures is that people remember the experience of discomfort differently due to additive memory biases (Fredrickson, 2000). A secondary explanation however, is that variability in discomfort intensity throughout the day becomes a salient feature in a people's memory in comparison to pain that may be intense but stable (Stone, Schwartz, Broderick, & Shiffman, 2005). Thus, these salient memories may become the foundation on which patients with high discomfort variability may base their subsequent appraisals of painful events.

When considering how this relationship may impact people's intention to persist in an activity that is likely to elicit variable levels of physical discomfort, one possibility is that people will rely on salient pain memories experienced during prior engagements to inform their intention to repeat that activity in the future. Providing supportive evidence on this position, Redelmeier, Katz, & Kahneman (2003) found that patients who had a greater tendency to focus on salient peaks in past painful episodes felt less satisfied with their ongoing treatment regime, which in turn, decreased the likelihood that they would continue to persist with that regime in the future (Stone et al., 2005). Taken as a whole,

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the findings from Stone et al. (2005) and Redelmeier et al. (2003) may indicate that people who experience a high degree of discomfort variability during a task may overemphasize salient pain experiences while generating their decision to repeat or quit (e.g., persistence) that task in the future at the conclusion of the present task. Consequently, these people may be more likely to quit that task in comparison to people who experienced less discomfort variability during the task.

While these findings may provide a useful starting point to evaluate how the experience of physical discomfort may affect learning, there are several discrepancies that must first be made resolved. First, the events described in Stone et al. (2005) and Redelmeier et al. (2003) occurred over somewhat lengthy timeframes (e.g., 24 hours or longer). Considering that learning tasks often occur over much shorter time intervals due to attentional demands or cognitive fatigue (Healy, Kole, Buck-Gengler, & Bourne, 2004), it remains unclear how physical discomfort might shape learning persistence over short periods of time. Second, the intensity of physical discomfort encountered by the patients in Stone et al. (2003; 2005) and Redelmeier et al. (2003) is presumably much higher than what would typically occur while attempting an effort learning activity. Thus, additional research is needed to determine whether similar relationships or behaviors may exist among learning tasks that elicit low to moderate levels of physical discomfort. Lastly, while affective response formation has become a fairly well researched topic in judgment and decision making over recent decades, little is presently known about the relationships between affective response formation during learning tasks that involve physical discomfort. The learning literature may benefit from studying these relationships

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through the lens of EVT in order to understand the relationship between physical discomfort, expectancies, and value beliefs.

Learning Equipment and Expectancy-Value Theory

Over recent decades, multiple literature communities from learning and skill acquisition have emphasized the need to evaluate the learning process through an individual-in-context perspective (Renninger, Hidi, & Krapp, 2014; Beltman et al., 2007; Pintrich, 2000). In contrast to earlier learning perspectives which regarded learning outcomes as a function of individual characteristics and task complexity, the learner-in-context perspective argues that learning outcomes are highly dependent on the social, cultural, and environmental context in which the learning process unfolds (Pintrich, 2000). However, while this perspective has become a foundational aspect of contemporary educational psychology, the literature has focused to a far greater extent on the context that surround the individual learner (e.g., present knowledge, social relationships) as well as task demands (e.g., instructional design, delivery of feedback), while the underlying environmental context remains relatively under-investigated (Brymer & Renshaw, 2010).

In response to this limitation, subfields such as learning ergonomics have begun shifting the current focus of the individual-in-context perspective to incorporate several principles from the field of human factors (Benedyk, Woodcock, & Harder, 2009; Smith, 2007; Woodcock, 2007). Smith (2007) proposes that the subfield of learning ergonomics addresses the myriad interactions that may occur within the learning context and environment. In this respect, learning ergonomics is intended to account for factors that affect the learning context, in addition to how the context itself affects learning outcomes.

Preliminary findings from educational ergonomics have revealed that the context surrounding the learning environment may influence learners to a greater extent than initially anticipated. For instance, while using a systems approach to classroom learning, Caldwell (1992) estimated that university students experienced a 10-25% decrease in learning efficiency when the classroom environment included poorly designed chairs, low air quality, and high external noise levels (Smith, 2007). More recently, Rudolf & Griffiths (2009) reported that table height and chair clearance (e.g., beneath the table or desk) were two prominent issues that contributed to decreased comfort levels, productivity, and attention among college students. However, while these preliminary findings are certainly a step in the right direction for educational ergonomics, no available research to date has investigated how learning equipment that learners use as an essential part of the learning process may impact their learning outcomes, expectancies, and value perceptions related to a task.

This lack of empirical interest seems particularly surprising when considering that several researchers (e.g., Davids, Brymer, Seifert, & Orth, 2013; Brymer et al., 2010; Benedyk et al., 2009; Davids et al., 2008; Smith, 2007; Kao, 1976) have stressed that differences in physical equipment design may impact learning outcomes differently depending on learners' physiological attributes, knowledge, and skills. Additionally, given the wide variety of disciplines that require learners to interact with equipment in order to participate in the learning process (e.g., athletes with safety equipment, musician with instruments), the need for additional research in this subfield is apparent. In this respect, EVT may provide a useful framework to evaluate these relationships, since it operates along the assumption that learning outcomes are not a product of singular factors

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(e.g., motivation, effort), but rather a product of several interactive factors operating in tandem (e.g., expectancies, value perceptions, cost perceptions). Consequently, analyses conducted through EVT may provide unique insights into the attitudes and beliefs that learning equipment may affect.

Ergonomic Design and Learning

One avenue that may provide initial context to the relationships between learning equipment and learning outcomes comes from past ergonomic literature discussing equipment design principles. Though the breadth of ergonomic research is beyond the scope of the present discussion, these ergonomic design principles are generally intended to improve the efficiency, satisfaction, and ease of use that users experience while interacting with equipment (Rubin & Chisnell, 2008). Thus, factors such as reducing the degree of difficulty and discomfort users experience while interacting with equipment may be a shared concern between the ergonomics literature and the EVT literature focused on cost-related beliefs. Among these ergonomic design principles, theorists have often advocated that equipment should be designed in ways that promote neutral posture and limb positions during sustained equipment use (Mason, van der Woude, Tolfrey, Lenton, & Goosey-Tolfrey, 2012; Lewis & Narayan, 1993). Yet despite the abundance of research demonstrating the value of postural neutrality, many of today's devices and equipment require non-neutral, awkward, and uncomfortable body positions to be sustained during equipment use.

The repercussions associated with these non-neutral body positions have been well documented across an assortment of settings, user groups, and equipment types (see MacIver, Smyth, & Bird, 2007). For instance, in the workplace setting, prolonged typing

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on conventionally designed computer keyboards has long been suggested to increase the risk of developing carpal tunnel syndrome (CTS) due to excessive wrist extension and ulnar deviation while typing (Rempel, Keir, & Bach, 2008). Relatedly, in medical settings, surgical equipment that requires users to apply extensive finger compression have been found increase the frequency and magnitude of hand fatigue and discomfort during lengthy surgical procedures (Xiao, Jakimowicz, Albayrak, & Goossens, 2012). Importantly though, these issues are not exclusive to work-related contexts. Indeed, similar equipment-related complaints and issues are commonly observed among users engaging in leisure activities as well. For example, Fjellman-Wiklund & Chesky (2006) proposes that due to the extensive use of non-neutral body, limb, and wrist positions performed by string musicians (e.g., cellists, guitarists) to compensate for the design of their instruments, these musicians are among the most likely to suffer from limb discomfort, repetitive strain injuries (RSI), and nerve damage following years of recreational participation.

As these collective results may pertain to EVT, it is possible that negative outcomes such as physical discomfort and injury could potentially impact learners' task value perceptions over time. Specifically, as learners experience greater discomfort due to their ongoing interactions with poorly fitting equipment, it is possible that their cost perceptions related to that task will increase as well. However, since much of the ergonomics literature discussing equipment design has focuses on performance outcomes (e.g., accuracy) and knowledgeable or skilled user groups, the relationship between equipment design, learning, and novice user groups remains largely unclear.

Scaled Equipment and Learning Outcomes

In comparison to the somewhat limited research discussing learning and equipment design from the ergonomics literature, a growing body of evidence from sports research has argued that scaling the size of learning equipment to fit the individual learner may provide several performance-related benefits (Davids et al., 2008; Pellett et al., 1998). Operationally, scaled equipment refers to equipment where either the whole object or certain parts of that object have been increased or decreased in size. Scaled equipment is often used as a method to offset inherent disadvantages present among some learners, such as their physical size (e.g., height, strength) or present skill level (Timmerman, Water, Kachel, Reid, Farrow, & Savelsbergh, 2015). For example, soccer coaches of young child athletes may encourage players to practice with a small-scale soccer ball (e.g., size 3-4; 23-26" circumference) to help smaller and weaker players develop effective kicking, passing, and ball handling skills with greatest ease. As these students grow older however, coaches may encourage these players to switch to a regulation size soccer ball (e.g., size 5; 27-28" circumference) to better match their increased foot size and kicking strength (Araújo, Davids, Bennett, Button, & Chapman, 2004).

In terms of performance outcomes, scaled equipment has been shown to present advantages among novices attempting to learn a new sport (Davids et al., 2008). For instance, Buszard et al. (2014a) illustrated this point in a study looking at novice child-aged tennis players who were provided with a small-scale, medium-scale, or adult-scale tennis racket. Buszard et al. (2014a) found that children who used the small-scale tennis racket demonstrated greater striking accuracy and consistency in comparison to children who used either the medium-scale or adult-scale tennis racket. In a similar study, Larson

& Guggenheimer (2013) found that beginner child-aged tennis players scored higher on a foreground hitting task while using a low compression tennis ball and smaller sized tennis court (e.g., scaled features) in comparison to players who used regulation equipment and courts. The authors propose that one reason for this finding was that the scaled equipment slowed the pace of play to a level that allowed players extra time to plan and react between volleys (Larson et al., 2013). This insight seems to corroborate with the previously discussed skill acquisition literature (e.g., Alexander, 2003) which advises novices may need extra time to reflect on new information, since both information and movements are still being processed at a conscious and deliberate level.

Outside the context of sports, additional support for the performance benefits associated with using scaled equipment has been reported in skill-based domains such as typing. for example, Pereira, Lee, Sadeeshkumar, Laroche, Odell, & Rempel (2012) investigated whether computer keyboards with varying degrees of horizontal key spacing (e.g., distance between two adjacent keys) would impact the typing accuracy and comfort experienced by participants with above average hand and finger sizes. They found that participants who used the small-scale (16.0mm) keyboard performed significantly worse in terms of accuracy and speed when compared to participants who used the standard-scale (19.0mm) keyboard. Additionally, participants who used the small-scale keyboard also reported comparatively higher levels of physical discomfort in their hands, wrists, and shoulders as well (Pereira et al., 2012).

These results are partially in contrast to an earlier study conducted by Yoshitake (1995), which employed a similar methodology among a group of participants with below-average hand and finger sizes. Unlike the participants with larger hands and

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fingers in Pereira et al. (2012), the smaller handed participants from Yoshitake (1995) performed equally well while using either the small-scale or standard-scale keyboard. Yoshitake (1995) advises that one explanation for these results is that since conventionally designed keyboards are produced with a standardized horizontal key spacing of 19.0mm, people with below-average hand and finger sizes may have previously altered their typing technique over the years to compensate. Importantly though, since Yoshitake (1995) did not address physical discomfort as a study variable, it remains unclear whether the keyboard size differences influenced participants experience of comfort as it did in Pereira et al. (2012).

Despite this difference however, the collective results from Yoshitake (1995) and Pereira et al. (2012) seems to indicate that using a one-size fits all approach to scaled equipment may not be effective. Instead, the direction and degree to which equipment is scaled must take into account physical characteristics of the person using the equipment. Additionally, these results may also lend preliminary support to the position that a suboptimal fit between a learner and learning equipment may introduce additional issues outside the spectrum of performance-related variables, such as a learner's physical comfort levels. When this latter relationship is viewed in tandem with the results from Redelmeier et al. (2003), it is possible that such factors could influence learners' cost perceptions toward a task, which in turn, may lower learning persistence.

Beyond the scope of performance-related variables, some studies from tennis specify that scaled equipment may also present additional advantages in terms of learning attitudes and beliefs (Timmerman et al., 2015). For example, Farrow & Reid (2010) found that novice child-aged tennis players reported higher task engagement while using

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scaled equipment in comparison to players who used regulation size tennis balls and courts during a series of rally tasks. Pellett et al. (1998) reported similar findings among a group of adult-aged novice tennis players using scaled or standard tennis racket as well. Learners in this study were provided with a tennis racket with either a 95" head (standard-scale) or a 110" head (large-scale). Those who used the large-scale racket reported greater attitudinal benefits, such as higher self-efficacy toward forehand and backhand tasks as well as fewer negative emotional responses toward their overall progress. In addition to these attitudinal and belief-related benefits, Buzzard, Farrow, Reid, & Masters (2014b) suggests that optimally scaled equipment may indirectly promote greater task attention. Buzzard et al. (2014b) argues that since scaled equipment can positively impact learners' accuracy and ease of learning, learners do not need to allocate as much working memory resources toward monitoring and attenuating errors. As a result, some learners may redirect those resources toward other aspects of the task, such as developing advanced strategies or techniques.

Although these findings provide supportive evidence for the use of scaled equipment during learning, there are several caveats that may preclude these findings from being generalizable to other learning disciplines and user groups. First, the study of scaled equipment as a whole has remained nearly exclusive to sports disciplines such as tennis. By contrast, no known research has investigated whether similar relationships exist within other skill-based disciplines, such as music education. This discrepancy seems somewhat surprising given the wide assortment of scaled musical instruments (e.g., child-sized violins, cellos, guitars) that are currently available. Furthermore, given the fact that music instructors commonly encourage novice music students to use scaled

instruments (e.g., child violins), there is an immediate need for research to inform these recommendations (Freitag, 2011). Second, the majority of this research (e.g., Timmerman et al., 2015; Buzzard et al., 2014a; 2014b; Larson et al., 2013; Farrow et al., 2010) has focused on studying child-aged learners, while the relationships between adult-aged learners and scaled equipment remains comparatively unexplored. Lastly, while some researchers have provided preliminary insights into how scaled equipment may impact learning attention, engagement, and beliefs (e.g., Buzzard et al., 2014b; Farrow et al. 2010; Pellet et al. 1998, respectively), a direct relationship between scaled equipment and learning attitudes, beliefs, and persistence has yet to be investigated.

The Current Study

The current study investigated whether the physical design of the learning equipment novices use will influence their expectancies and value perceptions toward an unfamiliar, effortful learning task. Additionally, this study addressed how these perceptions affect novices' overall learning persistence during their initial learning experience. In order to achieve these goals and extend earlier research, this study explored whether learning equipment that was ergonomically designed would facilitate better learning outcomes and experiences in comparison to conventionally designed learning equipment in the context of music education. The implications from this study are intended to inform EVT as well as the learning literature by exploring the relationship between equipment design and novices' motivational attitudes toward learning.

The domain of music education was selected as the focal point for this study for several reasons. First, the process of learning a musical instrument entails several similarities to the task demands described in Billeter et al. (2011). For example, learners

in both settings have to interact with skill-based equipment while engaged in the learning process. Additionally, both types of tasks typically involve steep initial learning curves. As advised by Billeter et al. (2011), these two qualities may be a key factors that contribute to the relationships reported in their study. Second, several findings have indicated that novice musicians often develop all-or-nothing belief expectancies about their musical abilities and skills during the initial stages of learning (Cremaschi, Ilinykh, Leger, & Smith, 2015; McPherson, 2000; Pitts et al., 2000). Consequently, if equipment design can alter the perceived difficulty of music education in a similar manner to the findings reported in the ergonomics and sports sciences literature, it is possible that these perceptions will be reduced during the initial stages of learning. Lastly, based on the high availability of scaled musical instruments in consumer markets today, there is an apparent need to determine whether these products provide any tangible benefits to novices.

In pursuit of studying the impact of learning equipment within music education, the electric guitar was chosen as this study's target of investigation due to its widespread popularity, yet comparatively high ratio of reported player discomfort (Fjellman-Wiklund et al, 2006). In terms of use in the United States, fretted instruments such as guitars are estimated to account for one of the largest group of instruments played by musicians, regardless of age or gender (NAMM Global Report, 2014). Additionally, since electric guitar sales have accounted for over a quarter of the estimated sales revenue over past decades within this population (NAMM Global Report, 2014), it is possible that results found in this study may benefit one of the largest subpopulations of musicians nationwide. Despite this popularity however, additional research demonstrates that many guitars' inherent design may be a primary factor leading players to experience both short-

term and long-term discomfort (Genani, Dekker, & Molenbroek, 2013; Woldendorp, van de Werk, Boonstra, Stewart, & Otten, 2013; Marmaras & Zarboutis, 1997). In light of these concerns, the electric guitar may be an optimal instrument to target in this study, since the incorporation of ergonomic principles into the redesign of the electric guitar could potentially reduce the experience of discomfort among novices. Based on these recommendations as well as the previously discussed relationships within the EVT and learning equipment literature, the following research questions and hypotheses were proposed.

RQ1: How does an ergonomic guitar influence novices' attitudes and perceptions compared to a conventional guitar?

RQ2: How does an ergonomic guitar influence novices' performance outcomes compared to a conventional guitar?

RQ3: How does an ergonomic guitar influence novices' learning persistence compared to a conventional guitar?

Seven hypotheses were developed based on observations report in the literature in order to explore these research questions. First, it was initially predicted that participants who used the ergonomic guitar would report higher confidence (e.g., expectancy beliefs) compared to those who used the conventional guitar. Second, participants who used the ergonomic guitar would indicate higher enjoyment ratings compared to those who used the the conventional guitar. Third, participants who used the ergonomic guitar would indicate higher interest ratings compared to those who used the the conventional guitar. Fourth, participants who used the ergonomic guitar would report lower difficulty ratings for learning the guitar in comparison to those who used the conventional guitar. Fifth,

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participants who used the ergonomic guitar would report lower physical discomfort ratings in comparison to those who used the conventional guitar. Sixth, those who used the ergonomic guitar would perform better during practice tasks than those who used the conventional guitar. Lastly, participants who used the ergonomic guitar would indicate higher learning persistence in comparison to those who used the conventional guitar.

CHAPTER 2

METHOD

Participants

Four participant requirements were implemented during the recruitment stages of this

study to promote the validity of the data that was collected. First, to ensure that

participants were capable of understanding the task instructions and requirements, only

participants that were able to speak and understand the English language were permitted.

Second, due in part to the gaps in the equipment-related literature regarding adult

learners, only participants 18 years or older were eligible to participate in this study.

Third, since a central component of this study focuses on novice learners, only

participants with six weeks or less experience playing the guitar were permitted to

participate. This timeframe was selected based on recommendations provided in the

music education literature (e.g., Costa-Giomi, 2004; McPherson, 2000), which suggests

that six weeks is a common quitting point for many beginner musicians. Additionally,

only participants who have not practiced on the guitar in the last 5 years were eligible to

participate. This requirement was intended to reduce the number of participants who have

some guitar-related knowledge, but may not practice on a habitual or consistent basis.

Lastly, all participants included in the final analyses were required to complete both the

online study and in-person study.

Fifty-two participants from Arizona State University participated in this study in

exchange for partial course credit. Preliminary analyses indicated that most participants

self-identified as male (71.2%; $SD = .458$) as well as Caucasian (50%; $SD = .505$) (see

Table 1).

Table 1

Demographic Characteristics of Study Participants

Characteristic	%	*SD*
Male	71.7%	0.455
Caucasian	49.1%	0.505
Middle Eastern	18.9%	0.395
Asian	9.4%	0.295
Hispanic	9.4%	0.295
Multiethnic	9.4%	0.295
Native American	3.8%	0.192
African American	1.9%	0.137

In terms of participants' past experiences with the guitar, over one-third identified as having access to a guitar while growing up (40.4%), while a quarter of the participants indicated that they presently have access to a guitar at home (24.5%). In accordance with the study requirements, all participants indicated the ability to speak and understand English, were at least 18 years old (mean = 21.5 years; *SD* = 5.079), had less than 6 weeks of guitar experience in the past 5 years, and did not know how to play the guitar at the time of the study. Over one-third of the participants (35.8%; *SD* = .484) in this study had previously attempted to learn the guitar during their lifetime, but eventually quit for reasons that were not explored in this study. Table 2 shows these additional demographic characteristics in further detail.

Table 2

Demographic Characteristics of Study Participants - Continued

Characteristic	%	SD
Grew up with a guitar at home	40.4%	0.496
Attempted to learn the guitar in the past	35.8%	0.484
Has current access to a guitar at home	24.5%	0.434
Currently knows how to play an instrument	24.5%	0.434
Currently knows how to play the guitar	0.0%	0.000

Descriptive statistics revealed that participants held generally positive attitudes and beliefs toward learning the guitar. The majority of participants reported that they expected the process of learning the guitar to be moderately enjoyable, interesting, and socially valuable. Likewise, most participants were somewhat confident in their ability to learn the guitar. In terms of cost-related perceptions however, participants generally rated the guitar as somewhat difficult to learn. Interestingly, participants often disagreed with each other regarding the level of physical discomfort that learning the guitar would elicit; some believed it wouldn't cause any discernable discomfort, while a smaller subset of participants believed it would cause a moderately high level of physical discomfort. These data are displayed in further detail in table 3. Although the reasoning behind these initial physical discomfort ratings were not a primary focus in this study, follow-up studies should seek further clarification from participants regarding these attitudes and beliefs.

Table 3

Pre-test Expectancy-Value beliefs

Characteristic	Minimum	Maximum	Mean	*SD*
Confidence ratings	1.0	7.0	4.79	1.419
Enjoyment ratings	3.0	7.0	5.39	1.115
Interest ratings	3.0	7.0	5.39	1.080
Social value ratings	3.0	7.0	5.57	1.248
Difficulty ratings	2.0	7.0	4.83	1.297
Overall discomfort ratings	0.0	47.2	19.63	14.084

[a]Refers to the collective total of 6 sub-category ratings (e.g., fingers, hands, wrists, forearms, shoulders, and back); each category was rated independently on a 10-point scale.

Lastly, analyses of pre-test learning persistence ratings illustrated that participants generally expressed a slight to moderate desire to learn the guitar. On average, participants indicated that they expected to practice slightly less than half-an-hour at a time, and believed that they would practice about three days each week. Table 4 displays these data in further detail.

Table 4

Pre-Test Learning Persistence Ratings

Characteristic	Minimum	Maximum	Mean	*SD*
Desire to learn the guitar	1.7	10.0	6.22	2.605
Est. minutes per practice session	0.0	60.0	27.10	16.331
Est. days of practice per week	0.0	7.0	3.00	1.683

Materials

Pre-Test Questionnaire. Participants accessed the pre-test questionnaire through a survey link hosted online through *Qualtrics*. The initial screens of this questionnaire presented the study's first consent form (see Appendix A), introduced the scope of study, and participation requirements. Afterwards, participants responded to a few demographic-related prompts to indicate their gender, age, and ethnicity. Following the demographic questions, participants answered questions about their prior experience with several musical instruments (e.g., violin, guitar, saxophone, flute, and piano). Questions within this portion of the questionnaire captured quantitative aspects of participants' prior experiences, such as how many minutes he or she typically practiced as well as how many years he or she practiced the target instrument.

For each of the musical instruments that a participant had not attempted to learn in the past, a series of question were presented regarding his or her expectancy and value beliefs as well as cost-related perceptions toward learning that instrument. Each question was responded to on a seven-point semantic differential scale. Afterwards, a second series of questions asked participants to indicate the level of physical discomfort he or she anticipated to experience in various parts of the body (e.g., fingers, back) while attempting to the learn the instrument. Each response was indicated by using a slider-scale that spanned from 0 (e.g., no discomfort) to 10 (moderate or above discomfort).

At the conclusion of each instrument question set, participants were presented with a final series of questions regarding how they would practice at home. Specifically, participants reported an estimate of how many minutes per practice session, days per week, and number of months they expected to continue practicing with the target

instrument. Each response to these questions were indicated through a numeric slider-scale that corresponded with the prompt. In total, participants responded to five series of questions corresponding with each of the target musical instruments (see Appendix B).

Preliminary Instructional Video. The preliminary instructional video introduced participants to the basics of using an electric guitar, such as how to hold the guitar while seated, and how to use a guitar pick. This video also introduced essential guitar-related terminology to the participant as well, such as the terms, "guitar neck", "strings", and "frets". All participants were instructed to pause and rewind this video at their discretion to ensure that they had sufficient opportunity to familiarize themselves with the terminology. In total, the preliminary instructional video played for a complete running time of 4 minutes, 30 seconds (see Appendix C)

Task 1 Demonstration Video. The task 1 demonstration video provided a visual and auditory demonstration of how to play the "E major" and "A minor" chords on the guitar. Two picture were presented simultaneously: one showing a chord diagram of the target chord, the other showing the instructor's fingers as he played the same chord. As this video played, participants were instructed to watch and listen to the demonstration while holding the guitar, but refrain from attempting the task on their own until prompted by the study facilitator. In total, this video played for a complete running time of 30 seconds (see Appendix C).

Task 1 Instructional Video. The task 1: instructional video provided an overview of the two chords previously shown in the task 1: demonstration video (e.g., "E major" and "A minor"). Afterwards, the video instructor demonstrated where the participant should place his or her fingers while attempting to perform these two chords

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in a step-by-step manner. Through this video, the instructor provided tips and technical advice regarding how to perform these two chords effectively. The study facilitator instructed the participants to pause and rewind this segment of the video at their discretion to ensure that each participant was familiar with the chords and finger placements prior to the subsequent performance trials.

Following the instructional portion of this video, the rest of the video was edited into three separate blocks to correspond with the three performance trials the participants attempted. Each performance trial was accompanied by the same video used in the pre-task 1: instructional video, but in a longer format. That is, a video demonstration consisting of the music track, chord chart, and finger positions each participant should aim to replicate during their performance attempts. In total, each performance trial took place for approximately 2 minutes, with a 30 second black screen during each trial to serve as a rest period for additional questioning from the study facilitator (see Appendix C).

Task 2 Demonstration Video. The task 2 demonstration video provided a visual and auditory demonstration of how to play the "G major" and "C major" chords on the guitar. Two picture were presented simultaneously: one showing a chord diagram of the target chord, the other showing the instructor's fingers as he played the same chord. As this video played, participants were instructed to watch and listen to the demonstration while holding the guitar, but refrain from attempting the task on their own until prompted by the study facilitator. In total, this video played for a complete running time of 30 seconds (see Appendix C).

Task 2 Instructional Video. The task 2 instructional video walked through a brief introduction to the two chords previously shown in the pre-task 1: instructional video (e.g., "G major" and "C major"). Afterwards, the video instructor demonstrated where the participant should place his or her fingers while attempting to perform these two chords in a step-by-step manner. Through this video, the instructor provided tips and technical advice regarding how to perform these two chords effectively. The study facilitator instructed the participants to pause and rewind this segment of the video at their discretion to ensure that each participant was familiar with the chords and finger placements prior to the subsequent performance trials.

Following the instructional portion of this video, the rest of the video was edited into three separate blocks to correspond with the three performance trials the participants attempted. Each performance trial was accompanied by the same video used in the pre-task 2: instructional video, but in a longer format. That is, a video demonstration consisting of the music track, chord chart, and finger positions each participant should aim to replicate during their performance attempts. In total, each performance trial took place for approximately 2 minutes, with a 30 second black screen during each trial to serve as a rest period for additional questioning from the study facilitator (see Appendix C).

Pre-Task Questionnaire. The pre-task questionnaire instructed participants to make series of predictive judgments regarding their expectancy (e.g., confidence) and value (e.g., enjoyment, difficulty, discomfort, etc.) beliefs toward the task he or she watched in the target pre-task instructional video. These questions were essentially identical to the questions asked in the online questionnaire. In both questionnaires, for

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example, participants responded to questions such as, "how interesting or not interesting do you find this task?". All responses were indicated on a seven-point semantic differential scale corresponding with the prompt in question. Afterwards, participants responded to a series of questions about how much physical discomfort he or she anticipated to experience in various body parts (e.g., fingers, back) while attempting the task. Similar to the online questionnaire, all responses were indicated on a slider-scale that spanned from 0 (e.g., no discomfort) to 10 (e.g., moderate or above discomfort) (see Appendix C).

Post-Task Questionnaire. The post-task questionnaire will ask participants to report on what they experienced while performing either Task 1 or Task 2. This survey will consist of similar questions that were presented in the pre-task survey. For instance, participants will complete a series of questions regarding how much physical discomfort they experienced as well as questions regarding their expectancy and value perceptions. However, unlike the pre-task survey which focused on predictive judgments, this survey will ask participant to report on their actual experience of attempting a task. Additionally, the questions at the end of this survey will ask participants to make new predictions about their performance and confidence before they attempt the task again (see Appendix C).

Learning Persistence Questionnaire. The learning persistence questionnaire presented a series of questions regarding participants' perceptions of attempting to practice and learn the guitar in the future. Specifically, participants responded to several quantitative-oriented questions, such as how long they anticipated to practice in a single practice session, how many days per weeks they believed they would dedicate to practicing the guitar, and how many months they thought they would remain

continuously engaged in the learning process. Similar to the set of persistence-related

questions presented within the online questionnaire, all responses were indicated using a

numeric slider-scale (see Appendix C).

Standard Electric Guitar. The standard electric guitar (see Figure 1) used in this

study was a Epiphone Les Paul Special II guitar. This guitar was selected since it is one

of the more frequently purchased electric guitars by novice and beginner guitarists.

Consequently, any results found in this study may present valuable insights into how a

large segment of beginner guitarists are influenced by the guitar's design.

Figure 1. Standard Electric Guitar

Ergonomic Electric Guitar. The ergonomic electric guitar (see Figure 2) is a custom designed electric guitar that incorporates several recommendations from expert and amateur luthiers as well as design recommendations found in the music education literature (e.g., Genani et al., 2013; Marmaras et al., 1997). Based on these recommendations, four primary design changes were incorporating while designing this guitar for the present study that differentiate it from the control guitar. These design differences are described in Table 6.

Figure 2: Ergonomic Electric Guitar

Table 5

Design features of the ergonomic guitar used in this study

Fundamental design issue	How the issue applies to guitar design	Specific design recommendation	Rationale for this design recommendation
Equipment should be designed in ways that allow natural alignment between the hand, wrist, and forearm during use (Lewis & Narayan, 1993).	The overwhelming majority of commercial guitars use a single scale length approach. This may lead guitarists to rotate their shoulder, elbow, and wrist to compensate for the vertical frets (e.g., non-neutral position) farthest away from their body, which in turn, may increase ulnar deviation and elbow strain.	Use a multi-scale ("fanned fret") scale length approach.	A multi-scale approach changes the layout of the frets, making it so that the outermost frets point inward toward the guitarist on the underside of the neck when the guitar is held in playing position. Consequently, the shoulder, elbow, and wrist remain aligned more frequently.
Equipment should be designed in ways that encourage non-acute joint angles to occur during use (Chihara, Izumi, & Seo, 2014).	Most commercial guitar necks are produced with an almost flat surface across its width. This may promote guitarists to experience greater wrist flexion as their playing hand moves further away from their body (Ranelli, Straker, & Smith, 2011).	Use a Torzal Twist design on the guitar's neck.	According to expert luthier, Jerome Little, the Torzal Twist design promotes less wrist flexion by angling (e.g., "twisting") the neck and bridge in different directions by several degrees. Thus, less wrist flexion is likely to occur, which in turn, will reduce discomfort.
Equipment should be designed in ways that requires as little static force to be applied by the user to operate the equipment during sustained use (Garg, Waters, Kapellusch, & Karwowski, 2014).	Most commercial guitars employ a single standardized scale length (e.g., 24.75 or 25.5") depending on the manufacturer. However, these scale lengths may to too long and present too much tension for some guitarists, particularly novices (Marmaras et al., 1997).	Use a shorter scale length	Since a guitar string's weight, diameter, and tension can be a controlled variable, reducing the length that it spans will reduce its $lb./sq.ft^2$ tension. Therefore, less force is needed to displace the string's position, making the strings easier to press down.
Equipment should be designed in ways that promote even weight distribution during use (León, & Galindo, 2014).	Most commercial guitars have metal tuning machines at the far end of the neck. While in playing positioning, these parts make the guitar unbalanced in terms of weight, which in turn, causes the guitarist to compensate by supporting the weight of the neck with their fretting hand.	Use a headless neck design	A headless neck design typically entails that the metal tuning machines are relocated to the body of the guitar. As a result, the weight of these parts plays less of a factor in terms of balance, since this position is closer to the fulcrum point at which the guitar is naturally positioned while playing.

Design

This study employed a randomized mixed methods design with a control condition. The guitar that participants were randomly assigned was treated as a between subjects' independent variable, while pre-test and post-test questionnaire measures were treated as a within subjects' dependent variable. Participants who were assigned to use the standard electric guitar were classified as being in the control condition. Alternatively, participants who were assigned to use the ergonomic electric guitar were classified as being in the experimental condition. Regardless of condition however, both groups of participants received the same set of questionnaires, instructional videos, and performance trials.

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Additionally, the ordering of these measures were presented in an identical manner between condition groups.

Procedure

Prospective participants began this study by completing the perquisite online questionnaire via *Qualtrics*. This questionnaire began with presenting the online consent form, then a series of questions concerning participants' personal experiences and history with five musical instruments. Afterwards, participants completed a total of five question-based modules that corresponded with each of these instruments. Questions within these modules corresponded with various dimensions of the EVT framework as well as proxy measures of learning persistence. After completing the initial online questionnaire, participants' responses were screened to determine whether they satisfied the aforementioned study requirements for the in-person portion of the study. Those who met the study requirements were invited back to participate in the in-person study for additional course credit (e.g., 1 credit hour) through the Psychology subject pool.

The in-person portion of the study began with the participant providing consent, then being introduced to the types of tasks and questions he or she would encounter during the study. Afterwards, the participant was supplied the guitar that he or she was randomly assigned to at the outset of the study. The participant was then instructed to watch the preliminary instructional video and attempt to follow the steps and tasks being demonstrated. While watching this video, the participant was instructed to pause and rewind the video as needed until he or she felt comfortable with the terminology and requirements.

Once familiarized with the basic terminology and mechanics of the guitar, the participant proceeded to watch the task 1 demonstration video. During this video, the study facilitator instructed the participant to only watch and listen to the video, refraining from attempting the task at this point in the study. Based on this demonstration video, the participant completed the first pre-task questionnaire to evaluate the types of expectancy and value beliefs he or she had toward attempting this task following some additional instruction. For example, participants responded to questions such as, "how confident are you that you will perform this task successfully?"; "how difficult do you find this task?" Subsequently, the participant was instructed to watch and play along with the task being performed in the task 1 instructional video. While watching and playing, the participant was encouraged to pause and rewind the video, if needed. At the conclusion of this video, the study facilitator provided feedback to help the participant place his or her fingers in the correct areas as well as a general recap of the video and task.

After the instructional phase of the video, the participant attempted to use the information he or she had learned and apply it during three performance trials. Each participant was instructed to play along with the video cues to the best of their abilities. The study facilitator recorded the audio of each trial attempt for subsequent analyses. Between each trial, a 30 second break was provided to the participant. During this break, the participant verbally addressed the level of overall physical discomfort he or she had experienced during the previous trial on a scale of 0 (e.g., no discomfort) to 10 (e.g., moderate or above discomfort). This process was repeated only at the conclusion of trials 1 and 2. Afterwards, the participant completed the questions from post-task

questionnaire, starting with the physical discomfort questions, then progressing to the expectancy and value belief-related questions.

The same process outlined above was repeated once again for the second playing task. That is, the participant watched the task 2 demonstration video, responded to the pre-task 2 questionnaire, watched and attempted the second task over a series of three trials, then completed the post-task questionnaires. With the exception of the video content and task, the questions, ordering, and format were identical to the first task. Afterwards, the participant responded to the learning persistence questionnaire, completed the post-task questionnaire, and was debriefed by the study facilitator.

Analyses

Preliminary analyses revealed that 122 participants had completed all the questions from the online questionnaire. Among these data, a total of 107 participants indicated responses that confirmed he or she met all of the aforementioned requirements for this study. Over the span of the six weeks in which the data collection process took place, there was an attribute rate of 36.6%, leaving a total of 62 eligible participants who signed up for in-person study. However, due to technical issues, 3 participants' responses were determined unusable and were eliminated from the data set. Five additional participant responses were removed after it was determined during the study that they had too much guitar experience to be considered a novice. An additional participant's responses were removed from the data set after being determined statistical outliers on several questions. In sum, a total of 53 participants provided useable data from both the online questionnaire and in-person study. The subsequent results and discussion reflect analyses conducted on these data.

CHAPTER 3

RESULTS

Confidence Toward Learning: H₁

It was anticipated that participants who used the ergonomic guitar would report higher

confidence (e.g., expectancy beliefs) toward learning the guitar in comparison to those

who used the standard guitar. A preliminary analysis was conducted to determine the

means and standard deviations for the two study conditions (see Table 6). Due to the

slightly higher mean confidence ratings observed in the experimental condition, a one-

way analysis of variance (one-way ANOVA) was conducted to determine whether these

group differences may have had a statistically significant impact on subsequent analyses

involving participant confident ratings. This analysis showed no difference between

participants in the ergonomic and control condition pre-test confidence scores, $F(1, 51) =$

0.212, $p = .647$, $R^2 = .067$ (see Table 7). Thus, this finding was interpreted as an

indication that participants from both conditions expressed comparable levels of

confidence prior to attempting any study-related tasks.

Table 6

Pre-Test Confidence: Means and Standard Deviations

Condition	Mean	*SD*
Standard	4.70	1.659
Ergonomic	4.89	1.143

Table 7

Pre-Test Confidence: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.434	1	0.434	0.212	0.647
Within Groups	104.283	51	2.045		
Total	104.717	52			

A one-way ANOVA was calculated for each participants' post-test confidence ratings. This analysis revealed that participants in the ergonomic condition reported significantly higher levels of confidence than those in the standard condition at the conclusion of the study, $F(1, 51) = 5.951$, $p = .018$, $R^2 = .319$ (see Tables 8 & 9). As a result, hypothesis 1 was accepted.

Table 8

Post-Test Confidence: Means and Standard Deviations

Condition	Mean	SD
Standard	3.96	1.581
Ergonomic	4.81	.801

Table 9

Post-Test Confidence: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.45	1	9.451	5.951	0.018
Within Groups	81.00	51	1.588		
Total	90.453	52			

Enjoyment Toward Learning: H₂

It was anticipated that participants in the ergonomic condition would report higher enjoyment toward learning the guitar following their initial learning experience in comparison to those in the control condition. A comparison of condition means and standard deviations revealed an almost identical rating of enjoyment among participants in both conditions at pre-test (see Table 10). A one-way ANOVA was confirmed that these two groups were not statistically different at pre-test, $F(1, 51) = .437$, $p = .512$, $R^2 = .091$ (see Table 11).

Table 10

Pre-Test Enjoyment: Means and Standard Deviations

Condition	Mean	SD
Standard	5.30	1.235
Ergonomic	5.50	0.990

Table 11

Pre-Test Enjoyment: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.550	1	.550	.437	0.512
Within Groups	64.130	51	1.257		
Total	64.679	52			

A one-way ANOVA was calculated for each participants' post-test enjoyment ratings. This analysis revealed that participants in the ergonomic condition reported significantly higher levels of anticipated enjoyment than those in the standard condition

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at post-test, $F(1, 51) = 5.92$, $p = .019$, $R^2 = .319$ (see Tables 12 & 13). In light of this

finding, hypothesis 2 was accepted.

Table 12

Post-Test Enjoyment: Means and Standard Deviations

Condition	Mean	SD
Standard	4.85	1.703
Ergonomic	5.77	0.908

Table 13

Post-Test Enjoyment: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11.147	1	11.147	5.920	0.019
Within Groups	96.023	51	1.883		
Total	100.170	52			

Interest Toward Learning: H3

It was hypothesized that participants in the ergonomic condition would report higher

interest following their initial learning experience in comparison to those who used the

control guitar. An initial analysis of condition means and standard deviations revealed a

slightly higher group average among the ergonomic condition participants (see Table 14).

Consequently, a follow-up one-way ANOVA was conducted to determine whether these

differences may affect subsequent analyses concerning interest ratings. This analysis

showed no statistically significant differences between conditions in terms of pre-test

interest ratings, $F(1, 52) = 1.44$, $p = .236$, $R^2 = .165$ (see Table 15). Thus, this finding was

interpreted as an indication that there were no condition differences in terms of pre-test learning interest.

Table 14

Pre-Test Interest: Means and Standard Deviation

Condition	Mean	SD
Standard	5.22	1.155
Ergonomic	5.58	0.987

Table 15

Pre-Test Interest: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.666	1	1.666	1.44	.236
Within Groups	59.013	51	1.157		
Total	60.679	52			

Similar to the procedure used during analyses, a one-way ANOVA of post-test interest was conducted to determine differences between condition groups. This analysis revealed that while participants in the ergonomic condition reported higher levels of interest than those in the control condition, there was no statistically significant difference overall, $F(1, 51) = 2.517$, $p = .119$, $R^2 = .211$ (see Tables 16 & 17). As a result, hypothesis 3 was rejected.

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Table 16

Post-Test Interest: Means and Standard Deviation

Condition	Mean	SD
Standard	4.56	1.553
Ergonomic	5.15	1.156

Table 17

Post-Test Interest: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.741	1	4.741	2.517	.119
Within Groups	96.051	51	1.883		
Total	100.792	52			

Learning Difficulty: H4

It was predicted that participants in the ergonomic condition would report higher the

learning process to be less difficult following their initial learning experience in

comparison to those who used the control guitar. An evaluation of condition means and

standard deviations revealed comparable perceptions of learning difficulty among

participants in both conditions (see Table 18). Additionally, a one-way ANOVA of pre-

test difficulty ratings confirmed that there were no significant differences based on

condition assignment, $F(1, 51) = .088$, $p = .768$, $R^2 = .061$ (see Table 19).

Table 18

Pre-Test Difficulty: Means and Standard Deviation

Condition	Mean	SD
Standard	4.78	1.340
Ergonomic	4.86	1.275

Table 19

Pre-Test Difficulty: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.151	1	1.51	0.088	0.768
Within Groups	87.321	51	1.712		
Total	87.472	52			

Afterwards, one-way ANOVA was conducted to determine whether any changes in difficulty ratings at post-test occurred. Results from this analysis revealed that perceptions of task difficulty did not reliably differ between participants groups at post-test, $F(1, 51) = .738$, $p = .394$, $R^2 = .118$ (see tables 20 & 21). Thus, hypothesis 4 was rejected.

Table 20

Post-Test Difficulty: Means and Standard Deviation

Condition	Mean	SD
Standard	5.67	1.177
Ergonomic	5.42	.857

Table 21

Post Difficulty: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.786	1	.786	0.738	.394
Within Groups	54.346	51	1.066		
Total	55.132	52			

Learning Physical Discomfort: H$_5$

It was hypothesized that participants in the ergonomic condition would anticipate experiencing lower physical discomfort during learning process in comparison to those who used the control guitar. An evaluation of condition means and standard deviations revealed that participants from both conditions held similar beliefs regarding how much overall discomfort they should expect to encounter while learning the guitar (see Table 22). Subsequently, a one-way ANOVA of pre-test physical discomfort ratings was conducted, revealing no statistically significant differences between condition groups, F(1,51) = 1.233, p = .272, R^2 = .151 (see Table 23). Interestingly, unlike participants earlier ratings, the high standard deviations for both conditions in this category seems to indicate that participants generally held a wide range of beliefs regarding the intensity of physical discomfort they may encounter. In other words, it appears that some perceived the learning process to elicit hardly any discomfort, while others believed it would cause moderate or even considerable discomfort.

Table 22

Pre-Test Physical Discomfort: Means and Standard Deviations

Condition	Mean	*SD*
Standard	21.73	14.625
Ergonomic	17.44	13.431

Table 23

Pre-Test Physical Discomfort: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	243.463	1	1.558	0.836	0.365
Within Groups	10070.680	51	1.862		
Total	10314.143	52			

In line with prior analyses, a one-way ANOVA was conducted to determine whether whether condition assignment influenced physical discomfort ratings at post-test. While this analysis did indeed approach statistical significance, it did not reach the *a priori* threshold, $F(1, 51) = 3.300$, $p = .075$, $R^2 = .243$ (see Tables 24 & 25). Consequently, hypothesis 5 was rejected.

Table 24

Post-Test Physical Discomfort: Means and Standard Deviations

Condition	Mean	*SD*
Standard	21.426	15.139
Ergonomic	14.508	12.390

Table 25

Post-Test Physical Discomfort: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	633.945	1	633.945	3.300	0.75
Within Groups	9796.430	51	192.087		
Total	10430.375	52			

Performance Outcomes:H_6

Several steps were taken to evaluate participant performance in this study. Initially, participant audio recordings were relabeled to de-identify which condition the audio recording originally came from. A master key was created to match this new label with the original condition labels and ordering once the scoring process was completed. Audio recordings were scored based on four categories corresponding with performance: finger placement, clarity, chord switching, and strumming.

The category of finger placement related to how accurate the participant was in placing his or her fingers in the correct positions during the trial. Clarity related to whether the participant was able to play the task clearly. That is, without muffling or playing "dead strings" by preventing a guitar string from resonating. Chord switching referred to how quickly the participant was able to switch between guitar chords once prompted by the video instructions. Strumming related to whether the participant was able to keep a steady, accurate strumming pattern that closely aligned with the pattern shown and heard through the video. Each of these four categories were subjectively rated upon review based on a scale of 1 (poor) to 5 (perfect or near perfect). Since each participant attempted two separate tasks (e.g., task 1, task 2) for a total of three trial each

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(e.g., trial 1, trial 2, trial 3), this yielded a total of 6 audio recordings to be reviewed per participant. In total, 320 audio files were reviewed and rated based on the aforementioned performance scales. Once each recording was coded based on these criteria, each of the four performance dimensions were summed to establish an overall performance score for each trial attempt. The following analyses reflect these summed totals as the dependent variable.

Prior to reviewing these audio recordings, it was hypothesized that participants in the ergonomic condition would perform with greater accuracy over the three performance trials in comparison to those who used the control guitar. A split-plot ANOVA was conducted for each practice task, using the three performance trials within each task as the repeated dependent measure, and condition as an independent between subjects' variable. Contrary to predictions for hypothesis 6, these analyses revealed that performance did not significantly differ due to condition effects for task 1, F(1, 51) = .239, p = .627, or for task 2, F (1, 51) = .001, p = .979 (see Tables 26 & 27). Thus, hypothesis 6 was rejected.

Table 26

Task 1 Performance: Split-Plot ANOVA

Source	Tyle III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	25641.03	1	25641.026	663.227	0.000	0.93
Condition	9.26	1	9.256	0.239	0.627	0.005
Error	1933.051	50	38.661			

Table 27

Task 2 Performance: Split-Plot ANOVA

Source	Tyle III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	21420.41	1	21420.410	602.296	0.000	0.923
Condition	0.03	1	0.026	0.001	0.979	0.000
Error	1778.231	50	35.565			

Learning Persistence: H7

It was hypothesized that participants in the ergonomic condition would report higher learning persistence following their initial experience of learning in comparison to those who used the control guitar. Since this study attempted to measure learning persistence through qualitative variables (e.g., desire to learn) as well as quantitative variables (e.g., minutes per practice session, days of practice per week), individual analyses were conducted for both variables. A comparison of the relationships between these variables indicated moderate to strong agreement at pre-test and post-test ratings (see Tables 28 & 29). In light of the high level of agreement between these variables, a single learning persistence variable was calculated based on the interaction between the two variables with the strongest relationships at both pre-test and post-test. As a result, only the two quantitative variables – minutes per practice session and days of practice per week – were used for subsequent analyses focusing on learning persistence.

Table 28

Correlation Matrix for Pre-Test Learning Persistence Measures

		Desire to Learn	Mins.	Days
Desire to learn	Pearson's *r*	1	.543**	.683**
	Sig. (2-Tailed)		0.000	0.000
	N	53	53	53
Mins.	Pearson's *r*	.543**	1	.696**
	Sig. (2-Tailed)	0.000		0.000
	N	53	53	53
Days	Pearson's *r*	.683**	.696**	1
	Sig. (2-Tailed)	0.000	0.000	
	N	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

Table 29

Correlation Matrix for Post-Test Learning Persistence Measures

		Desire to Learn	Mins.	Days
Desire to learn	Pearson's *r*	1	.639**	.632**
	Sig. (2-Tailed)		0.000	0.000
	N	53	53	53
Mins.	Pearson's *r*	.639**	1	.749**
	Sig. (2-Tailed)	0.000		0.000
	N	53	53	53
Days	Pearson's *r*	.632**	.749**	1
	Sig. (2-Tailed)	0.000	0.000	
	N	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

A one-way ANOVA confirmed that participants head approximately the same learning persistence attitudes at pre-test regardless of condition, $F(1, 51) = .636$, $p = .429$, $R^2 = .109$ (see Tables 30 & 31).

Table 30

Pre-Test Learning Persistence: Means and Standard Deviations

Condition	Mean	SD
Standard	111.260	121.387
Ergonomic	88.699	79.450

Table 31

Pre-Test Learning Persistence by Condition

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6741.694	1	6741.694	0.636	0.429
Within Groups	540910.538	51	10606.089		
Total	547652.232	52			

A one-way ANOVA was conducted to establish whether any changes in learning persistence may have occurred at post-test due to condition. Contrary to prediction, this analysis revealed no significant difference between condition in respect to learning persistence, $F(1, 51) = .073$, $p = .788$, $R^2 = .043$ (see Tables 32 & 33). Thus, hypothesis 7 was rejected.

Table 32

Post-Test Learning Persistence: Means and Standard Deviations

Condition	Mean	SD
Standard	93.981	96.827
Ergonomic	100.058	62.142

Table 33

Post-Test Learning Persistence: One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	489.020	1	489.020	.073	0.788
Within Groups	340302.164	51	6672.591		
Total	340791.185	52			

CHAPTER 4

DISCUSSION

The aim of this study was to determine whether the type of learning equipment novices use during their initial learning experience may positively or negatively shape their future learning perceptions. A mixed methods design was used to examine the types of beliefs that novices held prior to attempting a series of learning-related tasks as well as after these experiences. To explore the influence that different types of learning equipment may have on novices learning beliefs, half of the participants were randomly assigned to use a conventional electric guitar, while the other half used an ergonomic electric guitar. All participants received the same set of instructions, performance tasks, and questions regardless of their assigned condition.

Several *a priori* hypotheses were developed for this study based on findings reported in the learning, judgment and decision making, and ergonomic literature. Broadly speaking, participants assigned to use the ergonomic guitar were hypothesized to express higher expectancy beliefs (e.g., confidence), higher value-related beliefs (e.g., interest, enjoyment), lower cost-related beliefs (e.g., task difficulty, physical discomfort), and higher learning persistence at post-test in comparison to participants assigned to use the conventional guitar. The results from this study revealed that the design of the learning equipment significantly affected participants' expectancy beliefs and a subcomponent of their value beliefs (e.g., anticipated enjoyment). By contrast, the design of the learning equipment was found to have no significant impact on participants' cost-related beliefs, some value beliefs (e.g., interest, social merit), and overall learning

persistence. The remaining sections discuss these findings in the order that they were presented in the results section.

Expectancy Beliefs

In line with earlier studies from the ergonomic and scaled equipment literature (e.g., Farrow et al., 2010; Pellett et al., 1998), the present study found that the type of learning equipment did indeed affect novices' perceptions of learning confidence at post-test. Considering that confidence has been found to be a chief predictor of persistence, achievement, and goal setting behaviors in music education (Cremaschi et al., 2015; Evans et al., 2012), sports (Farrow et al., 2010; Pellett et al., 1998), and outdoor activities (Davids et al., 2008), the present finding highlights the role that equipment design plays within this paradigm as well as the early stages of learning a musical instrument.

This finding also contributes to the equipment design literature by adding a broader basis for comparing the directionality and magnitude of study effect sizes. Among the few studies from this field that have reported effect sizes of learning confidence (e.g., Pellett et al., 1998), the present study's effect size of $d = 0.67$ offers a high level of agreement with earlier scaled equipment studies that have reported effect sizes within the range of $d = 0.47 – 0.76$. While additional research is needed before these parallels may be determined reliable and consistent over time, this early evidence provides a promising argument for continued research attempting to bridge expectancy-related beliefs, learning, and equipment design.

In order to identify the validity and reliability of these relationships, one caveat that will need to be resolved through future research is how factors such as time and additional learning experiences may affect learning confidence when using modified

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music equipment. Past studies evaluating learning confidence outside the context of equipment design have routinely advocated for the use of longitudinal study designs when evaluating factors such as learning motivation and expectancy beliefs (McPherson, 2000). These types of studies allow researchers to iteratively evaluate learning confidence over time, taking into account how such beliefs are shaped by various personal and environmental factors. In comparison, the present exploratory investigation offers only a snapshot of the initial learning experience, rather than an analysis of initial stages involved in the learning process. Due in part to this limited exposure, it is possible that the differences in learning confidence observed at post-test may have been a short-term artifact of the study procedure or the types of tasks that participants attempted. Future research is needed to substantiate the observations found in the present study before broader claims or recommendations can be proposed. For example, a longitudinal study design may help clarify whether the confidence gains afforded by the ergonomic guitar in this study would persist over time as novices encounter new practice activities and challenges associated with the learning process.

Value Beliefs

In respect to value beliefs, results supported the hypothesis that novices who used the ergonomic guitar reported a significant increase in anticipated enjoyment ratings of learning the guitar from pre-test to post-test. By contrast, those who practiced with the conventional guitar did not indicate a noticeable change in anticipated enjoyment ratings toward learning. This finding parallels earlier reports in which beginning tennis players who used equipment scaled to fit their skill level and physical size reported the learning experience as more enjoyable and positive overall in comparison to those who used

conventionally scaled equipment (Elliott, Reid, & Crespo, 2015). Farrow & Reid (2010).
Although the present study is among the first known studies to extend a similar bridge
between ergonomic equipment design and the context of music education, the
implications of this positive shift in anticipated enjoyment warrants further research and
practical consideration. According to McPherson & McCormick (1999), task value
beliefs such enjoyment play a significant role in predicting the types of cognitive
strategies a musician will employ during practice, the duration of their formal and
informal practice sessions, and ultimately how well they do on performance evaluations
(Renwick & McPherson, 2002). In light of these relationships, potential increases in
learning enjoyment due to the musical instrument itself may be an important
consideration for music instructors to consider for beginning students.

Contrary to reports from the sports equipment literature (e.g., Buszard et al.,
2016), the difference in equipment used by participants' in this study did not significantly
influence ratings of future learning interest. One possible explanation for this
inconsistency is that ratings of anticipated future enjoyment and future interest may be
influenced by different factors during the initial phases of learning. According to Interest
Theory (Krapp, 2005), substantive changes in learning interest (e.g., personal interest) are
most likely to occur over time as a learner encounters additional experiences in the
discipline or domain. These cumulative experiences help the learner develop a better
sense of the types of information, challenges, and aspects of the learning process that he
or she finds interesting. Thus, ratings of future interest may be less experientially based,
driven instead by the saliency of the attributes and content of the discipline that easily
come to mind. In regards to the present study, it may be possible that novices simply did

not encounter a broad enough assortment of information and experiences to warrant revising their future interest ratings at post-test. McPherson & Zimmerman (in press) notes that this anchoring effect is a common occurrence among beginner musicians who inherently have fewer experiences to extract the self-motivating benefits that a discipline may afford with continued learning.

In contrast, several studies from the field of judgment and decision making have illustrated that anticipated future states (e.g., future enjoyment) is influenced to a greater extent by present affective states (e.g., present enjoyment) (Hoogerheide & Paas, 2012; Kahneman & Thaler, 2006). According to Kahneman et al. (2006), present affective experiences (e.g., enjoyment, satisfaction) can elicit projection bias toward similar future activities. That is, activities or events that are perceived as enjoyable in the present will often continue to be viewed as a reliable cause of enjoyment in the future. In the present study, those who enjoyed learning and performing the practice tasks may also have anticipated that they would experience similar levels of enjoyment in the future. Consequently, it is possible that while future interest ratings may be influenced by participants' evaluation of salient discipline attributes (e.g., content, challenges), participants' future enjoyment ratings may have been shaped to a greater extent by their recent learning experiences themselves. However, future research focusing on novices' initial learning experiences in the domain of music should seek to clarify this relationship before new relationships are explored.

Cost Beliefs

Comparisons of gain score revealed that the type of guitar participants interacted with did not have a significant impact on task difficulty and physical discomfort perceptions.

Although these findings do not align with previous results from the scaled equipment literature (e.g., Buszard et al., 2014; Farrow et al., 2010; Davids et al., 2008), there are numerous factors that could have prevented significant differences from being detected in this study. First, to promote ecological validity in this study, participants were free to choose their own playing postures and strategies after watching the initial instructional video. In other words, the study facilitator did not provide individualized feedback to encourage proper strumming techniques, body postures, and arm positioning. Not surprisingly, participants often held the guitar differently, resulting in a mix of suboptimal and optimal playing positions across participants. Due in part to these different approaches, it is possible that playing posture may have confounded task difficulty and physical discomfort ratings across both conditions.

Similar confounding effects have been reported in prior musical instrument studies attempting to measure physical discomfort ratings during practice. For instance, Woldendorp, Werk, Boonstra, Stewart, & Otten (2013) found no significant relationship between muscle activation patterns and discomfort ratings in a study evaluating experienced bassists with and without prior pain complaints. Woldendorp et al. (2013) suggest that one reason they found a null result was because bassists were free to select whichever performance strategies and approaches they wished. It is possible that a similar factor may have affected novice participants' difficulty and physical discomfort ratings in the present study as well. Future studies may be able to clarify this factor by using a longer observational period, such as longer practice tasks or iteratively through a longitudinal design. Alternatively, future studies may reduce this confound by imposing

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stricter performance guidelines and corrective feedback over the course of the practice trials.

A second confound that may have influenced these results is the fact that each practice trial occurred over a relatively short period of time. Prior studies investigating the relationship between physical discomfort and sustained keyboard typing performance typically required participants to type continuously for periods of 5 minutes (Pereira et al., 2012). In other cases, participants typed continuously for 25 minutes (Baker, Cham, Hale, Cook, & Redfern, 2007). In the present study, participants practice continuously for comparatively shorter periods of time. Although no floor effects were observed in this study in regards to physical discomfort ratings, the data set was negatively skewed overall. Introducing additional tasks, altering tasks to be more effortful, and increasing the duration of each task may each be an effective way to reduce possible confounds due to task and time-related factors in follow up studies.

An additional factor worth exploring in the future is determining which design features may reliably contribute to altering task difficulty and physical discomfort perceptions. The present research took the perspective of attempting to study an assortment of ergonomic design recommendations simultaneously, rather than evaluating each factor in exclusivity. Future studies should determine which features – if any – contribute the most toward influencing task difficulty and physical discomfort ratings. Prior research focusing on ergonomic computer keyboard design has illustrated that seemingly small design differences, angles, and sizing can have a dramatic influence on task performance, user preferences, and comfort ratings (Pereira et al, 2012; Rempel et

al., 2008). Borrowing a similar granular perspective for future research regarding music equipment design may allow effective mapping between user and design attributes.

Performance Outcomes

Evidence from this study revealed that the type of learning equipment novices used while attempting to perform two practice tasks had little bearing on task performance. This finding seemed surprising considering that the research that has shown that an optimal fit between the user and equipment often leads to improved performance outcomes. According to Davids et al. (2008), one rationale for the improvements observed in the literature is that scaled equipment encourages the incorporation of effective movement patterns, thereby allowing the learner focus their attention on other self-regulatory aspects of performance such as planning and reflection (Buszard et al., 2014b).

Importantly however, achieving an optimal fit between the individual user and equipment is often a challenging and iterative process. For instance, in domains such as badminton, tennis, and golf, numerous biomechanical factors (e.g., hand span, arm length, overall height) and mechanical factors (e.g., swing speed, rotation) must be taken into account when attempting to match equipment to a player (Jackson, Holeyfield, Pederson, & Strasner, 2014; Gorwitzke & Waddell, 1994). Yet even once these factors have been taken into account, it is possible that resolving only the most extreme issues will lead to noticeably improved performance. In the cases of child tennis players discussed in prior research, for example, the difference between using appropriately scaled equipment and non-scaled equipment often resulting in players using effective performance techniques (e.g., swing the racquet with one hand) versus ineffective techniques (e.g., swinging the racquet with both hands), respectively (Jackson et al.,

2014). Thus, in these scenarios, the impact of scaling equipment had a fundamental influence on the basic performance strategies that children used when attempting to perform tennis practice activities. As this relationship may pertain to the present study, one possibility is that the performance constraints introduced by a standard electric guitar may be marginal in comparison to other disciplines discussed in the scaled equipment literature. In contrast to prior studies, participants in this study were not altering their basic performance techniques and strategies (e.g., holding the guitar atypically) in ways that strongly differed from other participants regardless of condition.

Critically however, this interpretation does not imply that there are conclusively no differences between the types of equipment, but rather that the magnitude of these differences may be more nuanced (McLoone, Jacobson, Hegg, & Johnson, 2010). Future studies may help determine the bounds of these relationships by accounting for participant biomechanical attributes in conjunction with using stratification or matching during recruitment and condition assignment to encourage similar sample group characteristics. Additionally, a longitudinal study design may be another useful way to help understand how these nuanced factors influence performance outcomes throughout the beginning stages of the learning process.

Learning Persistence

Results from the learning persistence questionnaire illustrated that the type of learning equipment participants used in this study did not significantly impact their learning persistence ratings at post-test. Beyond the aforementioned study limitations and constraints outlined above, one possible explanation for this non-significant different is that performance outcomes may have a more immediate impact on learning persistence

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ratings than previously anticipated at the start of the study. Pitts et al. (2000) proposes

that in addition to a student's intrinsic motivation and desire to learn, early successes and

failures can have a strong impact on practice achievement and persistence over time.

Longitudinal studies conducted by McPherson (2000) as well as Costa-Giomi et al.

(2005) offer supportive evidence for this perspective, suggesting that early performance

outcomes can play a meaningful role on the types of practice strategies, level of effort,

and commitment that beginners express when learning a new instrument. Thus, it is

possible that if significant performance differences were observed in this study, post-test

ratings of learning persistence may have significantly affected by this change as well.

Considering that changes in learning persistence did indeed trend in the predicted

direction and approached significance (e.g., p = .106), these factors may be worth

exploring to determine whether the results observed in the present study were due to

confounding variables, potential study artifacts, or a truly non-significant influence of the

learning equipment used in this study.

Study Limitations

There are a number of limitations within the present study that may have influenced the

observed results. In respect to sample limitations, the participants in this study may not

accurately reflect the population of learners actively seeking or considering to learn the

guitar. Although it is possible that participants were interested in learning the guitar – as

indicated by nearly 40% of participants past attempts at learning the guitar – other

motivational factors such as fulfilling course credit requirements may have contributed to

participants' decision to volunteer. Future studies may remedy this limitation by

recruiting from a less restrictive population, seeking out participants who express a genuine interest or intention to learn the guitar on their own in the near future.

A second limitation is that the practice tasks and instruction format were pre-selected ahead of time, rather than letting participants choose whichever tasks they find most interesting. In a naturalistic setting, it is likely that novices would seek out different tasks depending on their learning goals, music interests, and past learning experiences. Keebler, Wiltshire, Smith, Fiore, & Bedwell (2014) adds to this perspective, suggesting that unlike classical music instruments, the process of learning the guitar is often ill-defined, informal, and exploratory for most beginning guitarists. That is, unlike the more formalized and rigid learning process that beginners go through while attempting to learn a classical instrument with an instructor or through classes, beginning guitarists often approach the learning process as a leisure activity with fewer constraints to help guide the learning process. Due to the potential confounds that this open-ended choice may present in an empirical setting, participants in this study received the same series of practice task, instructions, and instructor feedback. It remains unclear whether some participants would have selected these practice tasks themselves – thereby positively skewing their task value beliefs – in a naturalistic setting, or whether participants would have opted for different practice tasks – thereby negatively skewing their task value beliefs.

A final limitation is that this study was restrictive in terms of the the practice time and overall duration. Recommendations from McPherson & Renwick (2010) suggest that beginning musicians should aim to practice for periods of 15 – 20 minutes, multiple times per week. By contrast, the total time-on-task for the present study was less than 10 minutes, collectively. Future research should consider a longitudinal design so that clear

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relationships can be observed between participants using a conventionally designed guitar and those using an ergonomically design guitar.

Conclusions and Future Research Directions

This study showed that the type of learning equipment that novices use while attempting to learn an unfamiliar musical instrument had a moderately large, positive impact on some dimensions of the EVT framework. Specifically, it was found that participants who interacted with the ergonomic guitar reported significantly higher changes in confidence ratings as well as anticipated enjoyment ratings in comparison to those who used the conventional guitar. Beyond this relationship however, it was determined that learning equipment type did not meaningfully impact learning interest, difficulty ratings, or expectations of physical discomfort. Furthermore, equipment type had no discernable influence on novices' task performance or learning persistence in this empirical setting.

These results appear to indicate that the type of learning equipment novices use plays a noteworthy role among their initial learning perceptions. Future research seeking clarification on the relationships between initial learning beliefs, persistence, and equipment design may remedy these limitations by using a more robust study design (e.g., longitudinal design) to capture changes in learning attitudes and motivational beliefs over time. Using this approach may help identify valuable changes in EVT-related perceptions throughout the initial stages of learning an unfamiliar domain. Despite the present study limitations however, these results add scope and breadth to the growing body of literature attempting to bridge ergonomics and education. To date, this study serves as the first known investigation attempting to extend and apply this body of research to the context of music education.

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APPENDIX A

PRE-TEST CONSENT FORM

Dear Participant,

You are invited to participate in a research study conducted by Joseph O'Brian (Graduate Student) and Dr. Rod Roscoe (Assistant Professor) in Human Systems Engineering at Arizona State University. This research examines what preferences, attitudes, and expectations people have toward learning various musical instruments.

To participate in this study you must: a.) **NOT** have played the guitar for longer than 6 weeks in the past 5 years, b.) be able to speak and understand the English language, c.) you must be at least 18 years old.

In this study you will begin by completing a demographic survey. Next, you will indicate whether you have had any experience attempting to learn any of the musical instruments presented. Afterwards, you will complete several short surveys regarding your perceptions and attitudes toward these musical instruments.

This study is expected to take 30 minutes or less. If you are participating via the Introductory Psychology Subject Pool, your participation will be compensated with 0.5 credits on the SONA System (e.g., .5 credit hours per .5 hours of participation). If you are participating on a volunteer basis, you will not receive compensation -- but we sincerely appreciate your time and assistance!

Your participation is voluntary. You may choose to withdraw at any time without penalty. If you are participating via the Subject Pool, any partial credit you have earned will be awarded.

Your responses will be confidential. The results of this study may be used in reports, presentations, or publications, but your name will not be used. To ensure confidentiality, a randomized study code will be used to disassociate your identity from any responses or information that you provide here.

One potential benefit of this study is that you may gain helpful insights into the attitudes and expectations that you have toward certain musical instruments. There are no foreseeable risks associated with your participation in this portion of the study.

If you have any questions, please contact the research team at *jobrian@asu.edu* or *rod.roscoe@asu.edu*. If you have questions about your rights as a participant, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board through the ASU Office of Research Integrity and Assurance: (480) 965-6788.

Please type in your first name and last initial (e.g., John S.) to indicate your voluntary consent for this study. This information will be de-identified after you complete the study.

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APPENDIX B

PRE-TEST QUESTIONNAIRE

What is your gender?
- ○ Male
- ○ Female
- ○ Other

What year were you born? (e.g., 1995)

What is your ethnicity? Select all that apply.
- ❑ Asian
- ❑ Black or African American
- ❑ Latino or Hispanic
- ❑ Middle Eastern or Arab
- ❑ Native American or Pacific Islander
- ❑ White or Caucasian

Which of the following musical instruments did you have access to at home while growing up? Select all that apply.
- ❑ Violin
- ❑ Guitar
- ❑ Saxophone
- ❑ Clarinet
- ❑ Piano
- ❑ I did not have access to any of these musical instruments

Which of the following musical instruments do you currently have access to at home? Select all that apply.
- ❑ Violin
- ❑ Guitar
- ❑ Saxophone
- ❑ Clarinet
- ❑ Piano
- ❑ I do not currently have access to any of these musical instruments

Which of the following musical instruments have you ever attempted to learn during your lifetime? Select all that apply.
❑ Violin
❑ Guitar
❑ Saxophone
❑ Clarinet
❑ Piano
❑ I have not attempted to learn any of these musical instruments

Which of the following musical instruments do you currently know how to play? Select all that apply.
❑ Violin
❑ Guitar
❑ Saxophone
❑ Clarinet
❑ Piano
❑ I do not currently know how to play any of these musical instruments

With the last question in mind, how many years have you known how to play the following musical instruments? Move the slider to "0", if you don't know how to play the instrument in question. Move the slider to "10" for each instrument you have currently played for 10 years or more.
_____ Violin
_____ Guitar
_____ Saxophone
_____ Clarinet
_____ Piano

What skill level would you say you can play the following musical instruments?

	Absolute beginner	Somewhat of a beginner	Intermediate	Somewhat advanced	Advanced	Extremely advanced
Violin	○	○	○	○	○	○
Guitar	○	○	○	○	○	○
Saxophone	○	○	○	○	○	○
Clarinet	○	○	○	○	○	○
Piano	○	○	○	○	○	○

Please rank the following musical instrument in order of most interested to learn at the top of the list to least interested to learn at the bottom of the list. Place any musical instruments that you already know how to play at the very bottom of the list (in no particular order).

_____ Violin
_____ Guitar
_____ Saxophone
_____ Clarinet
_____ Piano

You will now be focusing on the violin as the target musical instrument for the following questions.

How difficult do you think learning the violin would be?
○ Extremely difficult
○ Difficult
○ Somewhat difficult
○ Neutral
○ Somewhat easy
○ Easy
○ Extremely easy

How enjoyable do you think learning the violin would be?
○ Extremely enjoyable
○ Enjoyable
○ Somewhat enjoyable
○ Neutral
○ Somewhat unenjoyable
○ Unenjoyable
○ Extremely unenjoyable

How socially valuable (e.g., helps you make friends, helps you make money) do you think learning the violin would be for you?
○ Extremely valuable
○ Valuable
○ Somewhat valuable
○ Neutral
○ Somewhat not valuable
○ Not valuable
○ Extremely not valuable

How interesting do you think learning the violin would be?
○ Extremely interesting
○ Interesting
○ Somewhat interesting
○ Neutral
○ Somewhat not interesting
○ Not interesting
○ Extremely not interesting

How confident are you that you could learn the violin?
○ Extremely confident
○ Confident
○ Somewhat confident
○ Neutral
○ Somewhat unconfident
○ Unconfident
○ Extremely unconfident

How much physical discomfort (if any) would you expect to experience in the following body parts while attempting to learn the violin? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".

_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to learn the violin (if at all)?
_____ Desire to learn

If you had a violin at home, how many minutes do you think you would practice in a single practice session (if at all)?
_____ Total number of minutes per session

If you had a violin at home, how many days per week do you think you would practice (if at all)?
_____ Total number of days per week (avg.)

If you had a violin at home, how long do you think you would try to learn it (if at all)?
_____ Number of months you would keep trying to learn it

If you had a violin at home, which of the following phrases best captures how you would learn and practice with it over time?
❍ I would never even try it.
❍ I would try it out a couple times, but would most likely lose interest and stop altogether.
❍ I would stick with it for a couple weeks, but would most likely lose interest and stop altogether.
❍ I would stick with it for a couple weeks, stop for a while, try it out again, etc.
❍ I would stick with it for a few months, stop for a while, try it out again, etc.
❍ I would stick with it for multiple years with minor breaks (1 - 2 weeks) here and there.
❍ I would stick with it forever and practice almost every day.

You will now be focusing on the violin as the target musical instrument for the following questions.

How difficult is it to play the violin?
- ❍ Extremely difficult
- ❍ Difficult
- ❍ Somewhat difficult
- ❍ Neutral
- ❍ Somewhat easy
- ❍ Easy
- ❍ Extremely easy

How enjoyable is it to play the violin?
- ❍ Extremely enjoyable
- ❍ Enjoyable
- ❍ Somewhat enjoyable
- ❍ Neutral
- ❍ Somewhat unenjoyable
- ❍ Unenjoyable
- ❍ Extremely unenjoyable

How socially valuable (e.g., helped you make friends, helped you make money) is it to know how to play the violin?
- ❍ Extremely valuable
- ❍ Valuable
- ❍ Somewhat valuable
- ❍ Neutral
- ❍ Somewhat not valuable
- ❍ Not valuable
- ❍ Extremely not valuable

How interesting is it to play the violin?
- ❍ Extremely interesting
- ❍ Interesting
- ❍ Somewhat interesting
- ❍ Neutral
- ❍ Somewhat not interesting
- ❍ Not interesting
- ❍ Extremely not interesting

How confident do you feel that you could improve on the violin?
- ❍ Extremely confident
- ❍ Confident
- ❍ Somewhat confident
- ❍ Neutral
- ❍ Somewhat unconfident
- ❍ Unconfident
- ❍ Extremely unconfident

How much physical discomfort (if any) do you typically experience in the following body parts while practicing the violin? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to improve at playing the violin (if at all)?
_____ Desire to learn

Presently, how many minutes do you practice the violin in a single practice session (if at all)?
_____ Total number of minutes per session

Presently, how many days per week do you practice the violin (if at all)?
_____ Total number of days per week (avg.)

How long do you think you will continue to practice the violin in the future (if at all)?
_____ Number of months you would keep trying to learn it

Which of the following phrases best captures how you presently practice the violin?
- ❍ I never play it anymore.
- ❍ I play it a couple times here and there, but tend to stop for long periods of time.
- ❍ I play it regularly for a couple weeks, but tend to stop for long periods of time.
- ❍ I play it regularly for a couple weeks, stop for a while, then play it for a couple more weeks, etc.
- ❍ I play it regularly for a couple months, stop for a while, then play it for a couple more months, etc.
- ❍ I play it regularly over the year, but take very brief breaks off (e.g., 1 - 2 weeks).
- ❍ I have played it regularly ever since I started.

You will now be focusing on the guitar as the target musical instrument for the following questions.

How difficult do you think learning the guitar would be?
❍ Extremely difficult
❍ Difficult
❍ Somewhat difficult
❍ Neutral
❍ Somewhat easy
❍ Easy
❍ Extremely easy

How enjoyable do you think learning the guitar would be?
❍ Extremely enjoyable
❍ Enjoyable
❍ Somewhat enjoyable
❍ Neutral
❍ Somewhat unenjoyable
❍ Unenjoyable
❍ Extremely unenjoyable

How interesting do you think learning the guitar would be?
❍ Extremely interesting
❍ Interesting
❍ Somewhat interesting
❍ Neutral
❍ Somewhat not interesting
❍ Not interesting
❍ Extremely not interesting

How socially valuable (e.g., helps you make friends, helps you make money) do you think learning the guitar would be for you?
❍ Extremely valuable
❍ Valuable
❍ Somewhat valuable
❍ Neutral
❍ Somewhat not valuable
❍ Not valuable
❍ Extremely not valuable

How confident are you that you could learn the guitar?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How much physical discomfort (if any) would you expect to experience in the following body parts while attempting to learn the guitar? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to learn the guitar (if at all)?
_____ Desire to learn

If you had a guitar at home, how many minutes do you think you would practice in a single practice session (if at all)?
_____ Total number of minutes per session

If you had a guitar at home, how many days per week do you think you would practice (if at all)?
_____ Total number of days per week (avg.)

If you had a guitar at home, how long do you think you would try to learn it (if at all)?
_____ Number of months you would keep trying to learn it

If you had a guitar at home, which of the following phrases best captures how you would learn and practice with it over time?
- ❍ I would never even try it.
- ❍ I would try it out a couple times, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, stop for a while, try it out again, etc.
- ❍ I would stick with it for a few months, stop for a while, try it out again, etc.
- ❍ I would stick with it for multiple years with minor breaks (1 - 2 weeks) here and there.
- ❍ I would stick with it forever and practice almost every day.

You will now be focusing on the guitar as the target musical instrument for the following questions.

How difficult is it to play the guitar?
- ❍ Extremely difficult
- ❍ Difficult
- ❍ Somewhat difficult
- ❍ Neutral
- ❍ Somewhat easy
- ❍ Easy
- ❍ Extremely easy

How enjoyable is it to play the guitar?
- ❍ Extremely enjoyable
- ❍ Enjoyable
- ❍ Somewhat enjoyable
- ❍ Neutral
- ❍ Somewhat unenjoyable
- ❍ Unenjoyable
- ❍ Extremely unenjoyable

How socially valuable (e.g., helped you make friends, helped you make money) is it to know how to play the guitar?
- ⭕ Extremely valuable
- ⭕ Valuable
- ⭕ Somewhat valuable
- ⭕ Neutral
- ⭕ Somewhat not valuable
- ⭕ Not valuable
- ⭕ Extremely not valuable

How interesting is it to play the guitar?
- ⭕ Extremely interesting
- ⭕ Interesting
- ⭕ Somewhat interesting
- ⭕ Neutral
- ⭕ Somewhat not interesting
- ⭕ Not interesting
- ⭕ Extremely not interesting

How confident do you feel that you could improve on the guitar?
- ⭕ Extremely confident
- ⭕ Confident
- ⭕ Somewhat confident
- ⭕ Neutral
- ⭕ Somewhat unconfident
- ⭕ Unconfident
- ⭕ Extremely unconfident

How much physical discomfort (if any) do you typically experience in the following body parts while practicing the guitar? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to improve at playing the guitar (if at all)?
_____ Desire to learn

Presently, how many minutes do you practice the guitar in a single practice session (if at all)?

_____ Total number of minutes per session

Presently, how many days per week do you practice the guitar (if at all)?

_____ Total number of days per week (avg.)

How long do you think you will continue to practice the guitar in the future (if at all)?

_____ Number of months you would keep trying to learn it

Which of the following phrases best captures how you presently practice the guitar?
- ⭕ I never play it anymore.
- ⭕ I play it a couple times here and there, but tend to stop for long periods of time.
- ⭕ I play it regularly for a couple weeks, but tend to stop for long periods of time.
- ⭕ I play it regularly for a couple weeks, stop for a while, then play it for a couple more weeks, etc.
- ⭕ I play it regularly for a couple months, stop for a while, then play it for a couple more months, etc.
- ⭕ I play it regularly over the year, but take very brief breaks off (e.g., 1 - 2 weeks).
- ⭕ I have played it regularly ever since I started.

You will now be focusing on the saxophone as the target musical instrument for the following questions.

How difficult do you think learning the saxophone would be?
- ⭕ Extremely difficult
- ⭕ Difficult
- ⭕ Somewhat difficult
- ⭕ Neutral
- ⭕ Somewhat easy
- ⭕ Easy
- ⭕ Extremely easy

How enjoyable do you think learning the saxophone would be?
- ⭕ Extremely enjoyable
- ⭕ Enjoyable
- ⭕ Somewhat enjoyable
- ⭕ Neutral
- ⭕ Somewhat unenjoyable
- ⭕ Unenjoyable
- ⭕ Extremely unenjoyable

How interesting do you think learning the saxophone would be?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat not interesting
- ○ Not interesting
- ○ Extremely not interesting

How socially valuable (e.g., helps you make friends, helps you make money) do you think learning the saxophone would be for you?
- ○ Extremely valuable
- ○ Valuable
- ○ Somewhat valuable
- ○ Neutral
- ○ Somewhat not valuable
- ○ Not valuable
- ○ Extremely not valuable

How confident are you that you could learn the saxophone?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How much physical discomfort (if any) would you expect to experience in the following body parts while attempting to learn the saxophone? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to learn the saxophone (if at all)?
_____ Desire to learn

If you had a saxophone at home, how many minutes do you think you would practice in a single practice session (if at all)?

_____ Total number of minutes per session

If you had a saxophone at home, how many days per week do you think you would practice (if at all)?

_____ Total number of days per week (avg.)

If you had a saxophone at home, how long do you think you would try to learn it (if at all)?

_____ Number of months you would keep trying to learn it

If you had a saxophone at home, which of the following phrases best captures how you would learn and practice with it over time?
- ❍ I would never even try it.
- ❍ I would try it out a couple times, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, stop for a while, try it out again, etc.
- ❍ I would stick with it for a few months, stop for a while, try it out again, etc.
- ❍ I would stick with it for multiple years with minor breaks (1 - 2 weeks) here and there.
- ❍ I would stick with it forever and practice almost every day.

You will now be focusing on the saxophone as the target musical instrument for the following questions.

How difficult is it to play the saxophone?
- ❍ Extremely difficult
- ❍ Difficult
- ❍ Somewhat difficult
- ❍ Neutral
- ❍ Somewhat easy
- ❍ Easy
- ❍ Extremely easy

How enjoyable is it to play the saxophone?
- ❍ Extremely enjoyable
- ❍ Enjoyable
- ❍ Somewhat enjoyable
- ❍ Neutral
- ❍ Somewhat unenjoyable
- ❍ Unenjoyable
- ❍ Extremely unenjoyable

How socially valuable (e.g., helped you make friends, helped you make money) is it to know how to play the saxophone?
- ❍ Extremely valuable
- ❍ Valuable
- ❍ Somewhat valuable
- ❍ Neutral
- ❍ Somewhat not valuable
- ❍ Not valuable
- ❍ Extremely not valuable

How interesting is it to play the saxophone?
- ❍ Extremely interesting
- ❍ Interesting
- ❍ Somewhat interesting
- ❍ Neutral
- ❍ Somewhat not interesting
- ❍ Not interesting
- ❍ Extremely not interesting

How confident do you feel that you could improve on the saxophone?
- ❍ Extremely confident
- ❍ Confident
- ❍ Somewhat confident
- ❍ Neutral
- ❍ Somewhat unconfident
- ❍ Unconfident
- ❍ Extremely unconfident

How much physical discomfort (if any) do you typically experience in the following body parts while practicing the saxophone? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".

_____ Finger tips

_____ Hand

_____ Wrist

_____ Forearm

_____ Shoulder

_____ Back

How much would you like to improve at playing the saxophone (if at all)?

_____ Desire to learn

Presently, how many minutes do you practice the saxophone in a single practice session (if at all)?

_____ Total number of minutes per session

Presently, how many days per week do you practice the saxophone (if at all)?

_____ Total number of days per week (avg.)

How long do you think you will continue to practice the saxophone in the future (if at all)?

_____ Number of months you would keep trying to learn it

Which of the following phrases best captures how you presently practice the saxophone?
○ I never play it anymore.
○ I play it a couple times here and there, but tend to stop for long periods of time.
○ I play it regularly for a couple weeks, but tend to stop for long periods of time.
○ I play it regularly for a couple weeks, stop for a while, then play it for a couple more weeks, etc.
○ I play it regularly for a couple months, stop for a while, then play it for a couple more months, etc.
○ I play it regularly over the year, but take very brief breaks off (e.g., 1 - 2 weeks).
○ I have played it regularly ever since I started.

You will now be focusing on the clarinet as the target musical instrument for the following questions.

How difficult do you think learning the clarinet would be?
- ○ Extremely difficult
- ○ Difficult
- ○ Somewhat difficult
- ○ Neutral
- ○ Somewhat easy
- ○ Easy
- ○ Extremely easy

How enjoyable do you think learning the clarinet would be?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How interesting do you think learning the clarinet would be?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat not interesting
- ○ Not interesting
- ○ Extremely not interesting

How socially valuable (e.g., helps you make friends, helps you make money) do you think learning the clarinet would be for you?
- ○ Extremely valuable
- ○ Valuable
- ○ Somewhat valuable
- ○ Neutral
- ○ Somewhat not valuable
- ○ Not valuable
- ○ Extremely not valuable

How confident are you that you could learn the clarinet?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How much physical discomfort (if any) would you expect to experience in the following body parts while attempting to learn the clarinet? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to learn the clarinet (if at all)?
_____ Desire to learn

If you had a clarinet at home, how many minutes do you think you would practice in a single practice session (if at all)?
_____ Total number of minutes per session

If you had a clarinet at home, how many days per week do you think you would practice (if at all)?
_____ Total number of days per week (avg.)

If you had a clarinet at home, how long do you think you would try to learn it (if at all)?
_____ Number of months you would keep trying to learn it

If you had a clarinet at home, which of the following phrases best captures how you would learn and practice with it over time?

❍ I would never even try it.
❍ I would try it out a couple times, but would most likely lose interest and stop altogether.
❍ I would stick with it for a couple weeks, but would most likely lose interest and stop altogether.
❍ I would stick with it for a couple weeks, stop for a while, try it out again, etc.
❍ I would stick with it for a few months, stop for a while, try it out again, etc.
❍ I would stick with it for multiple years with minor breaks (1 - 2 weeks) here and there.
❍ I would stick with it forever and practice almost every day.

You will now be focusing on the clarinet as the target musical instrument for the following questions.

How difficult is it to play the clarinet?
❍ Extremely difficult
❍ Difficult
❍ Somewhat difficult
❍ Neutral
❍ Somewhat easy
❍ Easy
❍ Extremely easy

How enjoyable is it to play the clarinet?
❍ Extremely enjoyable
❍ Enjoyable
❍ Somewhat enjoyable
❍ Neutral
❍ Somewhat unenjoyable
❍ Unenjoyable
❍ Extremely unenjoyable

How socially valuable (e.g., helped you make friends, helped you make money) is it to play the clarinet?
○ Extremely valuable
○ Valuable
○ Somewhat valuable
○ Neutral
○ Somewhat not valuable
○ Not valuable
○ Extremely not valuable

How interesting is it to play the clarinet?
○ Extremely interesting
○ Interesting
○ Somewhat interesting
○ Neutral
○ Somewhat not interesting
○ Not interesting
○ Extremely not interesting

How confident did you feel that you could improve at playing the clarinet?
○ Extremely confident
○ Confident
○ Somewhat confident
○ Neutral
○ Somewhat unconfident
○ Unconfident
○ Extremely unconfident

How much physical discomfort (if any) do you typically experience in the following body parts while practicing the clarinet? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to improve at playing the clarinet (if at all)?
_____ Desire to learn

Presently, how many minutes do you practice the clarinet in a single practice session (if at all)?

_____ Total number of minutes per session

Presently, how many days per week do you practice the clarinet (if at all)?

_____ Total number of days per week (avg.)

How long do you think you will continue to practice the clarinet in the future (if at all)?

_____ Number of months you would keep trying to learn it

Which of the following phrases best captures how you presently practice the clarinet?
- ○ I never play it anymore.
- ○ I play it a couple times here and there, but tend to stop for long periods of time.
- ○ I play it regularly for a couple weeks, but tend to stop for long periods of time.
- ○ I play it regularly for a couple weeks, stop for a while, then play it for a couple more weeks, etc.
- ○ I play it regularly for a couple months, stop for a while, then play it for a couple more months, etc.
- ○ I play it regularly over the year, but take very brief breaks off (e.g., 1 - 2 weeks).
- ○ I have played it regularly ever since I started.

You will now be focusing on the piano as the target musical instrument for the following questions.

How difficult do you think learning the piano would be?
- ○ Extremely difficult
- ○ Difficult
- ○ Somewhat difficult
- ○ Neutral
- ○ Somewhat easy
- ○ Easy
- ○ Extremely easy

How enjoyable do you think learning the piano would be?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How interesting do you think learning the piano would be?
○ Extremely interesting
○ Interesting
○ Somewhat interesting
○ Neutral
○ Somewhat not interesting
○ Not interesting
○ Extremely not interesting

How socially valuable (e.g., helps you make friends, helps you make money) do you think learning the piano would be for you?
○ Extremely valuable
○ Valuable
○ Somewhat valuable
○ Neutral
○ Somewhat not valuable
○ Not valuable
○ Extremely not valuable

How confident are you that you could learn the piano?
○ Extremely confident
○ Confident
○ Somewhat confident
○ Neutral
○ Somewhat unconfident
○ Unconfident
○ Extremely unconfident

How much physical discomfort (if any) would you expect to experience in the following body parts while attempting to learn the piano?
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to learn the piano (if at all)?
_____ Desire to learn

If you had a piano at home, how many minutes do you think you would practice in a single practice session (if at all)?

_____ Total number of minutes per session

If you had a piano at home, how many days per week do you think you would practice (if at all)?

_____ Total number of days per week (avg.)

If you had a piano at home, how long do you think you would try to learn it (if at all)?

_____ Number of months you would keep trying to learn it

If you had a piano at home, which of the following phrases best captures how you would learn and practice with it over time?
- ❍ I would never even try it.
- ❍ I would try it out a couple times, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, but would most likely lose interest and stop altogether.
- ❍ I would stick with it for a couple weeks, stop for a while, try it out again, etc.
- ❍ I would stick with it for a few months, stop for a while, try it out again, etc.
- ❍ I would stick with it for multiple years with minor breaks (1 - 2 weeks) here and there.
- ❍ I would stick with it forever and practice almost every day.

You will now be focusing on the piano as the target musical instrument for the following questions.

How difficult is it play the piano?
- ❍ Extremely difficult
- ❍ Difficult
- ❍ Somewhat difficult
- ❍ Neutral
- ❍ Somewhat easy
- ❍ Easy
- ❍ Extremely easy

How enjoyable is it to play the piano?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How socially valuable (e.g., helped you make friends, helped you make money) is it to play the piano?
- ○ Extremely valuable
- ○ Valuable
- ○ Somewhat valuable
- ○ Neutral
- ○ Somewhat not valuable
- ○ Not valuable
- ○ Extremely not valuable

How interesting is it to play the piano?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat not interesting
- ○ Not interesting
- ○ Extremely not interesting

How confident did you feel that you could improve at playing the piano?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How much physical discomfort (if any) do you typically experience in the following body parts while practicing the piano? NOTE: the scale only goes from "no discomfort" to "moderate discomfort".

_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How much would you like to improve at playing the piano (if at all)?
_____ Desire to learn

Presently, how many minutes do you practice the piano in a single practice session (if at all)?
_____ Total number of minutes per session

Presently, how many days per week do you practice the piano (if at all)?
_____ Total number of days per week (avg.)

How long do you think you will continue to practice the piano in the future (if at all)?
_____ Number of months you would keep trying to learn it

Which of the following phrases best captures how you presently practice the piano?
- ❍ I never play it anymore.
- ❍ I play it a couple times here and there, but tend to stop for long periods of time.
- ❍ I play it regularly for a couple weeks, but tend to stop for long periods of time.
- ❍ I play it regularly for a couple weeks, stop for a while, then play it for a couple more weeks, etc.
- ❍ I play it regularly for a couple months, stop for a while, then play it for a couple more months, etc.
- ❍ I play it regularly over the year, but take very brief breaks off (e.g., 1 - 2 weeks).
- ❍ I have played it regularly ever since I started.

APPENDIX C

IN-PERSON CONSENT FORM

Dear Participant,

You are invited to participate in research conducted by Joseph O'Brian (Graduate Student) and Dr. Rod Roscoe (Assistant Professor) in Human Systems Engineering at Arizona State University. This research examines how learning decisions, outcomes, and persistence are influenced by the experiences you have while attempting to learn the electric guitar.

In order to participate in this study, you must meet all of the following requirements:
a.) you must speak and understand the English language;
b.) you must be at least 18 years old;
c.) you must have completed the online portion of this study;
d.) you must not have more than 6 weeks of experience learning the guitar (cumulatively) in the last 5 years.

In this study, you will attempt to perform two different playing tasks on the electric guitar. Prior to your attempts, you will be presented with a few short instructional videos to introduce the tasks as well as how to use the guitar itself. Both before and after each set of videos, you will complete a short survey. These surveys will ask you to indicate several perceptions that you may have, such as your performance expectations, confidence in learning the task, interest, task difficulty, etc. Additionally, these surveys will ask you to indicate how much physical discomfort (if any) you experienced or expect to experience while performing the tasks.

With your permission, we will audio record the practice sessions. These optional recordings will only be used to compare the notes played during the task to an "expert" version of the same task.

Your data will help us understand how learning expectations and value perceptions impact learning decisions, outcomes, and persistence.

Remember, your participation is voluntary. You may choose to withdraw at any time without penalty. If you are participating via the Subject Pool, any partial credit you have earned will be awarded.

Your responses will be confidential. The results of this study may be used in reports, presentations, or publications, but your name will not be used. To ensure confidentiality, a randomized study code will be used to disassociate your identity from any responses or information that you provide here.

One potential benefit of this study is that you may learn new practice techniques and exercises for playing the guitar, which may improve your guitar playing skill.

Potential risks of the study are minor and include only normal fatigue or discomfort associated with playing a guitar, which are not expected to exceed what you would typically experience while practicing in a non-research setting. Under no circumstances are you expected to push yourself beyond your comfort level. You reserve the right to stop playing or participating at any point.

The study is expected to require one hour or less. If you are participating via the Introductory Psychology Subject Pool, your participation will be compensated with 1 credit on the SONA System (e.g., 1 credit hour per 1 hour of participation). If you are participating on a volunteer basis, you will not receive compensation—but we sincerely appreciate your time and assistance!

If you have any questions concerning this study, please contact the research team at *jobrian@asu.com* or *rod.roscoe@asu.edu*. If you have questions about your rights as a participant, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance: (480) 965-6788.

To indicate your voluntary consent to this portion of the study, please type in your first name and the first letter of your last name (e.g., John S.).

APPENDIX D

IN-PERSON QUESTIONNAIRE

On the following screen, you will watch and listen to a brief instructional video introducing the "basics" of the guitar. After watching this video, you should have learned:
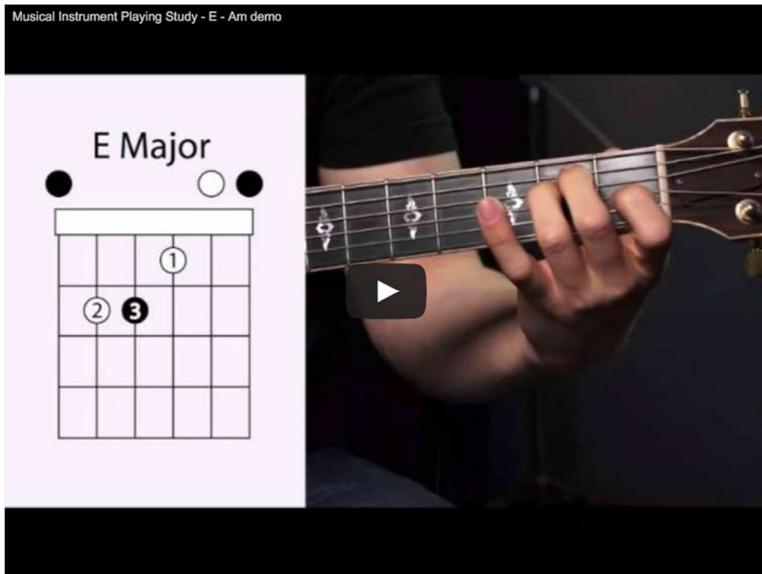
- How to hold a guitar while sitting down
- How to hold a guitar pick
- Where to position your hands and arms while playing
- What is meant by the term "guitar strings"
- What is meant by the term "frets"

Do your best to perform each step as it appears in the video. Feel free to pause or rewind the video at your leisure.

Visit: https://www.youtube.com/v/KKAxv9zLRAQ

Next, you will be presented with a short video demonstrating a new guitar playing task. Afterwards, you will be provided with an instructional video to help teach you to play this task. For the time being however, please do not play the guitar during the video – just watch and listen.

Visit: https://www.youtube.com/v/PsyuXOeMH-E

How confident are you that you will perform this task successfully?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How interesting do you think this task will be to perform?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat uninteresting
- ○ Uninteresting
- ○ Extremely Uninteresting

How difficult do you think this task will be to perform?
○ Extremely difficult
○ Difficult
○ Somewhat difficult
○ Neutral
○ Somewhat easy
○ Easy
○ Extremely easy

How satisfied did you think you will feel about your task performance?
○ Extremely disappointed
○ Disappointed
○ Somewhat disappointed
○ Neutral
○ Somewhat satisfied
○ Satisfied
○ Extremely satisfied

How enjoyable do you think this task will be to perform?
○ Extremely enjoyable
○ Enjoyable
○ Somewhat enjoyable
○ Neutral
○ Somewhat unenjoyable
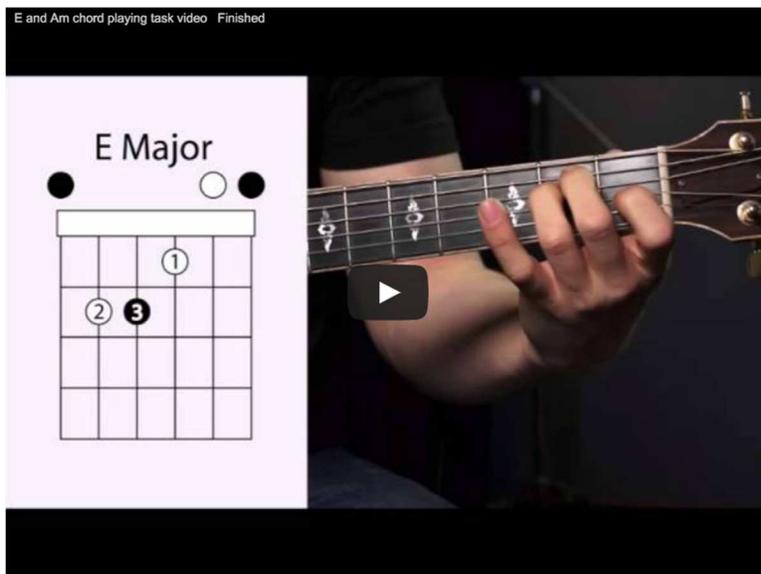○ Unenjoyable
○ Extremely unenjoyable

How helpful do you think learning this task will be toward learning the guitar as a whole?
○ Extremely helpful
○ Helpful
○ Somewhat helpful
○ Neutral
○ Somewhat unhelpful
○ Unhelpful
○ Extremely unhelpful

How much physical discomfort do you think you will experience in the following body parts while you attempt this task? Move the slider to best match your response.

_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

Next, you will be presented with an instructional video to help you learn to play the task you watched and listened to a moment ago. Please play along with this video to the best of your ability. Try not to worry about mistakes. Instead, do your best to keep up with the instructions and move your fingers in the correct spots on the guitar. Remember, this is a learning study and we don't expect you to be an expert at this task!

Visit: https://www.youtube.com/v/VkQBZAVETso

How much physical discomfort did you actually experience in the following body parts while you attempted this task? Move the slider to best match your response.

_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How interesting was this task?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat uninteresting
- ○ Uninteresting
- ○ Extremely Uninteresting

How difficult was this task?
- ○ Extremely difficult
- ○ Difficult
- ○ Somewhat difficult
- ○ Neutral
- ○ Somewhat easy
- ○ Easy
- ○ Extremely easy

How enjoyable was this task?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How satisfied do you feel about your task performance?
- ○ Extremely disappointed
- ○ Disappointed
- ○ Somewhat disappointed
- ○ Neutral
- ○ Somewhat satisfied
- ○ Satisfied
- ○ Extremely satisfied

How helpful do you think learning this task will be toward learning the guitar as a whole?
○ Extremely helpful
○ Helpful
○ Somewhat helpful
○ Neutral
○ Somewhat unhelpful
○ Unhelpful
○ Extremely unhelpful

If you were to attempt this task again, how confident are you that you would perform this task successfully?
○ Extremely confident
○ Confident
○ Somewhat confident
○ Neutral
○ Somewhat unconfident
○ Unconfident
○ Extremely unconfident

Next, you will be presented with a second short video demonstrating a new guitar playing task. Afterwards, you will be provided with an instructional video to help teach you to play this task. For the time being however, please do not play the guitar during the video – just watch and listen.
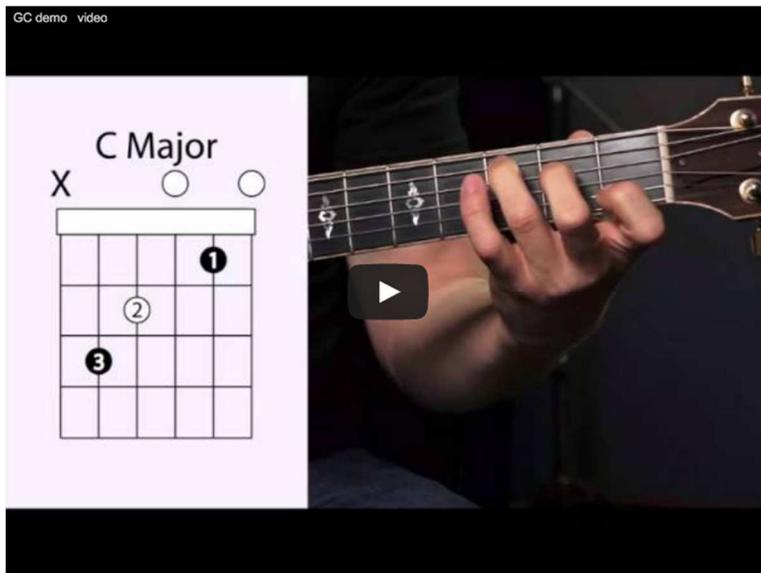
Visit: https://www.youtube.com/v/YKUUwi_UZak

How confident are you that you will learn and perform this task successfully?
- ○ Extremely confident
- ○ Confident
- ○ Somewhat confident
- ○ Neutral
- ○ Somewhat unconfident
- ○ Unconfident
- ○ Extremely unconfident

How interesting do you think this task will be to learn and perform?
- ○ Extremely interesting
- ○ Interesting
- ○ Somewhat interesting
- ○ Neutral
- ○ Somewhat uninteresting
- ○ Uninteresting
- ○ Extremely Uninteresting

How difficult do you think this task will be to learn and perform?
- ○ Extremely difficult
- ○ Difficult
- ○ Somewhat difficult
- ○ Neutral
- ○ Somewhat easy
- ○ Easy
- ○ Extremely easy

How satisfied did you think you will feel about your performance at this task?
- ○ Extremely disappointed
- ○ Disappointed
- ○ Somewhat disappointed
- ○ Neutral
- ○ Somewhat satisfied
- ○ Satisfied
- ○ Extremely satisfied

How enjoyable do you think this task will be to learn and perform?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How helpful do you think learning this task will be toward learning the guitar as a whole?
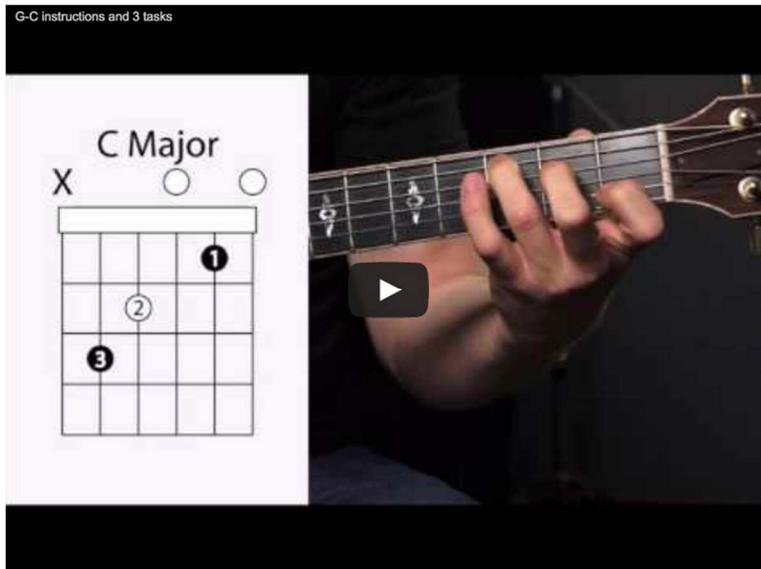- ○ Extremely helpful
- ○ Helpful
- ○ Somewhat helpful
- ○ Neutral
- ○ Somewhat unhelpful
- ○ Unhelpful
- ○ Extremely unhelpful

How much physical discomfort do you think you will experience in the following body parts while you attempt this task? Move the slider to best match your response.
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

Next, you will be presented with an instructional video to help you learn to play the task you watched and listened to a moment ago. Please play along with this video to the best of your ability. Try not to worry about mistakes. Instead, do your best to keep up with the instructions

and move your fingers in the correct spots on the guitar. Remember, this is a learning study and we don't expect you to be an expert at this task!

Visit: https://www.youtube.com/v/VegQabw9utk

How much physical discomfort did you actually experience in the following body parts while you attempted this task? Move the slider to best match your response.

_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How interesting was this task?
○ Extremely interesting
○ Interesting
○ Somewhat interesting
○ Neutral
○ Somewhat uninteresting
○ Uninteresting
○ Extremely Uninteresting

How difficult was this task?
- ○ Extremely difficult
- ○ Difficult
- ○ Somewhat difficult
- ○ Neutral
- ○ Somewhat easy
- ○ Easy
- ○ Extremely easy

How enjoyable was this task?
- ○ Extremely enjoyable
- ○ Enjoyable
- ○ Somewhat enjoyable
- ○ Neutral
- ○ Somewhat unenjoyable
- ○ Unenjoyable
- ○ Extremely unenjoyable

How satisfied do you feel about your task performance?
- ○ Extremely disappointed
- ○ Disappointed
- ○ Somewhat disappointed
- ○ Neutral
- ○ Somewhat satisfied
- ○ Satisfied
- ○ Extremely satisfied

How helpful do you think learning this task will be toward learning the guitar as a whole?
- ○ Extremely helpful
- ○ Helpful
- ○ Somewhat helpful
- ○ Neutral
- ○ Somewhat unhelpful
- ○ Unhelpful
- ○ Extremely unhelpful

If you were to attempt this task again, how confident are you that you would perform this task successfully?
○ Extremely confident
○ Confident
○ Somewhat confident
○ Neutral
○ Somewhat unconfident
○ Unconfident
○ Extremely unconfident

Please answer all the questions on this page with the following hypothetical scenario in mind: Imagine that you had the exact same electric guitar you used in this study at home. Also, imagine that you had plenty of spare time to practice as well as all the necessary equipment you would need (e.g., guitar amp, cords, picks, etc.).

How much would you like to continue learning this guitar on your own?
_____ Desire to learn

On average, how many minutes per session do you think you would practice this guitar on your own?
_____ Minutes per session (avg.)

On average, how many days per week do you think you would practice this guitar on your own?
_____ Days per week (avg.)

How long do you think you would keep trying to learn this guitar on your own?
_____ Number of months you would keep trying to learn the guitar on your own

How good do you think you would get at playing this guitar on your own?
_____ Skill level or ability

Please state your level of agreement with the following statements regarding the following performance goals.
_____ I would aim to learn a few basic chords or songs on the guitar
_____ I would aim to learn a bunch of different chords and songs on the guitar
_____ I would aim to write my own songs on the guitar
_____ I would aim to play guitar in a band with other musicians
_____ I would aim to play live shows for small audiences (on my own or with a band)
_____ I would aim to play live shows for large audiences (on my own or with a band)
_____ I would aim to play guitar semi-professionally or professionally

Would you be interested in scheduling a time to come back in and practice with this guitar just for fun (e.g., voluntarily) in the future?
○ No thanks, I only want to do this study.
○ Yes, I'm interested to come back in to practice with this guitar again.

How much physical discomfort would you expect to experience in the future, if you continued to learn the guitar on your own? Move the slider to indicate your response for each of the following body parts.
_____ Finger tips
_____ Hand
_____ Wrist
_____ Forearm
_____ Shoulder
_____ Back

How interested are you to continue learning the guitar on your own?
○ Extremely interested
○ Interested
○ Somewhat interested
○ Neutral
○ Somewhat uninterested
○ Uninterested
○ Extremely Uninterested

How difficult do you think it would be to continue learning the guitar on your own?
○ Extremely difficult
○ Difficult
○ Somewhat difficult
○ Neutral
○ Somewhat easy
○ Easy
○ Extremely easy

How confident are you that you could learn the guitar on your own?
- ❍ Extremely confident
- ❍ Confident
- ❍ Somewhat confident
- ❍ Neutral
- ❍ Somewhat unconfident
- ❍ Unconfident
- ❍ Extremely unconfident

How enjoyable do you think it would be to continue learning the guitar on your own?
- ❍ Extremely enjoyable
- ❍ Enjoyable
- ❍ Somewhat enjoyable
- ❍ Neutral
- ❍ Somewhat unenjoyable
- ❍ Unenjoyable
- ❍ Extremely unenjoyable

How socially valuable (e.g., helps you make friends, helps you make money) do you think it would be to continue learning the guitar on your own?
- ❍ Extremely valuable
- ❍ Valuable
- ❍ Somewhat valuable
- ❍ Neutral
- ❍ Somewhat not valuable
- ❍ Not valuable
- ❍ Extremely not valuable

How helpful do you think learning the guitar would be toward achieving other goals in your life?
- ❍ Extremely helpful
- ❍ Helpful
- ❍ Somewhat helpful
- ❍ Neutral
- ❍ Somewhat unhelpful
- ❍ Unhelpful
- ❍ Extremely unhelpful