# GUITAR LEARNING, PEDAGOGY, AND TECHNOLOGY: A HISTORICAL OUTLINE

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**Abstract**

This article offers a bird's-eye view of the evolution of guitar learning and pedagogy in the XX and XXI centuries, supported, and often propelled by emerging popular musical styles and new technologies. Specifically, the article discusses how learning to play guitar has evolved from formal teacher-student lessons in private and academic settings, to informal and self-guided forms of learning through books, magazines, and DVDs. Starting in the late 1990s, technological advancements and the diffusion of high-speed internet brought about technologies and social spaces that contributed to innovating guitar pedagogies and disrupting traditional approaches to teaching and learning the guitar. These technologies include, but are not limited to online archives and communities, social media, apps and software, subscription-based services, augmented reality, virtual worlds, and digital games. Several of these technologies are still in their infancy and their potential for impacting guitar learning and teaching may still to be fully harnessed and explored.

### Evolution of the Guitar

The earliest ancestors of the guitar are the Arabic oud and the Elizabethan lute, which have bowled bodies with an un-fretted fingerboard stringed in courses, which are two strings placed closely together, usually tuned in unison or octave pairs (Rossing & Caldersmith, 2010).

The Renaissance (c.1420 – c.1600) and Baroque (c.1600 – c.1750) periods saw the introduction of the Spanish vihuela, the four-course guitar, and the evolution of the Baroque guitar from five to six courses (French, 2014; Guy, 2013; Turnbull, 1991; Tyler, 1980; Wade, 2010).

The Romantic era (c.1800 – c.1850), which partially overlaps with the Classical period (c.1750 – c.1825), saw new developments in the design of the guitar in regards to its construction, appearance, and musical features (French, 2014; Guy, 2013; Tyler, 1980). By mid XIX century, Antonio de Torres Jurado brought all of the features together to form the classical guitar as we know it today (Alves, 2015; French, 2014).

In 1833, C. F. Martin & Co. developed the dreadnought acoustic guitar, while Orville Gibson started building steel string arch top hollow body guitars in the early 1900s (Guy, 2013). In the first decades of the XX century, the Rickenbacker "Frying Pan" (made for Hawaiian music) was the first guitar to use an electromagnetic transducer, later adopted by jazz musician Charlie Christian, who attached a pick-up to his Gibson ES150 in 1936 (French, 2014; Guy, 2013; Smith 1987). In 1949, Leo Fender introduced the Broadcaster, which later became the Telecaster, with the Stratocaster following soon after in 1954 (French, 2014; Millard, 2004). Around that same time, the Gibson Guitar Company started a fruitful collaboration with guitarist and inventor Les Paul, which led to the Gibson Les Paul model, first introduced in 1952 (French, 2014). Most of these electric guitar models, with minor or major variations, are still in production today and have become icons in music and popular culture.

**Guitar Learning and Pedagogy Before the XX Century**

In the XIX century, guitar teachers such as Dionisio Aguado (1784-1849) and Fernando Sor (1778-1839) composed etudes to teach right and left-hand techniques needed to play classical guitar pieces. At the time, these compositions served as the foundation for learning to play the guitar for children and adults from wealthy families who were studying with private teachers in churches or music conservatories (Alves, 2015; Glise, 2014). Learning to play the classical guitar was a formal process that required players to study and know how to read and perform music using proper right and left-hand techniques (Alves, 2015; Glise, 2014).

Soon after Torres refined the classical guitar into its modern form (ca. 1860), instructing guitar learners to properly sit and hold the instrument complemented etudes in forming the basis of classical guitar pedagogy (Glise, 2014). A fixed position was established with the classical guitar lining up the 12th fret toward the center of the body with the left foot propped up with a footstool (Alves, 2015; Glise, 2014). Many music compositions for the classical guitar, which was considered a solo instrument, were adapted and transposed from popular classical pieces originally written for other instruments (Alves, 2015; Glise, 2014). An example is J.S. Bach's first cello suite, which was originally written in the key of G and was then transposed to the key of D to accommodate the range of the classical guitar. Although music pieces for the classical guitar would evolve, the method of playing etudes while sitting and holding the classical

guitar would carry over virtually unchanged into XX century formal classical guitar education (Alves, 2015; Glise, 2014).

## Guitar Innovations and Pedagogies in the XX Century

### Guitar Learning and Pedagogy Between 1900 and 1950

The introduction of steel strings around 1900 inspired new ways of playing and learning the acoustic guitar. Up until that point in history, the acoustic guitar was tied with folk music brought to the United States by immigrants and was often played alongside the banjo and mandolin. Learning folk music on the acoustic guitar was mostly an informal process that was undocumented, learned by memory, and passed down by oral tradition (GBCbrad, 2011; Noonan, 2008). As the emerging ragtime and blues movements developing across the Mississippi Delta adopted the acoustic guitar, similar ways for learning the instrument were practiced (Bennett & Dawe, 2001; Obrecht, 2015). Guitarists from the Delta, such as Robert Johnson, were often poor and did not have access to formal music training (Obrecht, 2015).

Unlike the formal pedagogy of the classical guitar, which was solely based on written out music, ragtime and blues players of the period often learned to play the guitar informally through peer interaction with other musicians, learning by ear from records, or by self-taught methods that differed from guitarist to guitarist (Bennett & Dawe, 2001). Similar to the playing style of traditional folk guitarists, ragtime and blues guitarists used a combination of strumming and finger picking techniques. In these genres, most chord sequences relied on the circle of fifths "VI-II-V-I" progression. This allowed players to improvise, which would eventually influence jazz and rock guitar styles and pedagogies (Bennett & Dawe, 2001; Noonan, 2008). Contributing to the evolution of the acoustic guitar sound, the steel bar slide was first introduced in Hawaiian music and then adopted by early blues, country/hillbilly, and jazz players to produce that unique guitar sounds still heard and taught today throughout different playing styles (Ingram, 2010; Troutman 2013).

Beginning in the 1920s, radio broadcasting introduced jazz ensembles, early country music, and the blues to a large audience across the United States, becoming the primary popular source for music entertainment well into the early 1950s (Douglas, 1999). Becoming prominent in popularity through radio exposure, jazz ensembles began to move away from the banjo to the newly invented jazz hollow body guitars during the early 1930s (Dunscomb & Hill, 2002). With this new design also came a new approach to playing the jazz guitar, which gave rise to new ways of practicing and learning the instrument (Dunscomb & Hill, 2002; Sallis, 1996). The jazz guitar, unlike the blues guitar, did require the player to know chord progressions and read sheet music in order to perform with jazz ensembles (Dunscomb & Hill, 2002; Noonan, 2008; Sallis, 1996). To accommodate these jazz guitarists, in 1933 the Crescendo (a banjo,

mandolin, and guitar – or "BMG" – magazine publication) began publishing solos and "VI-II-V-I" chord progressions for the guitar (Noonan, 2008). However, it is largely unknown in what ways early jazz guitarists acquired their musical skills, if instructed by music teachers, through informal practices with the aid of books and magazines, or a combination of the two (Noonan, 2008).

Since the jazz guitar primarily began as a rhythm section instrument, its early pedagogy consisted of strumming simple chords and progressions (Dunscomb & Hill, 2002; Sallis, 1996). However, this began to change when jazz guitarist Eddie Lang developed the single string solo technique for jazz guitar, which was considered to be ahead of its time, expanding the guitar's role beyond the rhythm section (Sallis, 1996). This would be one of the most significant contributions to jazz guitar style, until Charlie Christian amplified his Gibson ES150 in 1936 (Sallis, 1996). This is when the jazz guitar style evolved from simply strumming chords to complex melodies, chord progressions, and improvised solos. Elaborating on the single string solo technique developed by Lang, jazz guitarists of the period transformed the jazz guitar into a solo instrument, which influenced guitar styles and music genres for decades (Dunscomb & Hill, 2002; Sallis, 1996).

### Guitar Learning and Pedagogy Between 1950 and 1991

Guitar models introduced in the 1950s would change the instrument, its pedagogy, and its role in music and popular culture. The Gibson Les Paul (1952), the Fender Telecaster (1952), and the Fender Stratocaster (1954) would all contribute to the birth and popularization of rock 'n' roll music (Ingram, 2010). In the 1950s, TV sets were becoming common in homes, which contributed to exposing millions of viewers to rock 'n' roll music and the electric guitar (Douglas, 1999; French, 2014; Ingram, 2010; R. A. Schwartz, 2006; Weinstein, 2013). From 1953 to 1960, guitarist and songwriter Les Paul and his duo with Mary Ford were aired on television five days a week, further contributing to the popularity of the electric guitar (JJAAHH, 2012). At the same time, radio was broadcasting rock 'n' roll, the blues, jazz, country, and many other genres, exposing a wide audience to different sounds and styles of playing the electric guitar (Brookes, 2005; French, 2014). Both radio and television would play a primary role in popularizing the guitar as a musical instrument and instilling in young generations a desire to learn how to play it (Brookes, 2005; French, 2014; JJAAHH, 2012).

Stylistically, riff and single string solo techniques, developed by Lang and expanded by Christian, were adopted by blues players such as T-Bone Walker to create new musical progressions and guitar sounds (JJAAHH, 2012; Millard, 2004; Waksman, 2001). Rock 'n' roll guitarists like Chuck Berry, Buddy Holly, and others developed their own styles by integrating features and techniques of blues, ragtime, country, and folk music (Ingram, 2010; JJAAHH, 2012; Millard, 2004; Waksman, 2001; Weinstein, 2013). The west coast surf

sounds headed by Dick Dale and his Fender Stratocaster gave birth to the fast-picking right hand and tremolo techniques that carried through the XX century. These techniques would later become the flagship of modern-day speed, thrash, black, and death metal genres that would emerge in the late 1980s (Ingram, 2010; Millard, 2004; Waksman, 2001).

As mentioned in the BBC series *Imagine: The Story of the Guitar* (fifteesrebel, 2011), learning to play the electric guitar in this era was revolutionized by Burt Weedon's (1957) book "Play in a Day: Guide to Modern Guitar Playing." Weedon's book quickly gained popularity and became the best-selling guitar instruction book of all time. Guitar players such as Eric Clapton (Cream), Paul McCartney and John Lennon (The Beatles), Brian May (Queen), and many others first learned how to play the guitar through Weedon's book (fifteesrebel, 2011). Weedon's techniques served as the foundation for these artists' songwriting, melodies, and chord progressions that influenced, and continue to influence, pop and rock guitar playing (Bennett & Dawe, 2001; Millard, 2004; Waksman, 2001).

The late 1960s would continue to foster the evolution of the electric guitar in the hands of rock guitarists such as Jimi Hendrix, Jimmy Page, Richie Blackmore, Robert Townshend, and Eric Clapton (Weinstein, 2013). These artists explored new ways of playing and approaching the instrument, thus contributing to the development of new styles and techniques that are still part of rock guitar learning and playing. For example, U.S. based *Guitar Player Magazine* (1967) began to print lessons with songs and playing techniques from these artists in their issues (Weinstein 2013). In 1964, *The Ed Sullivan Show* first premiered the Beatles, which would result in what was called "the British Invasion," catapulting them (as well as their guitar sound and playing style) to almost instant success in the United States (Bennett & Dawe, 2001; Ingram, 2010; Weinstein, 2013).

The punk rock movement of the 1970s introduced the concept of the three-chord songwriting technique, which would form the basis of almost every Sex Pistols and Ramones song. This style would also influence the British new wave, alternative rock, and 1990s Seattle grunge (Bennett, 2007; Easley, 2015). These evolved playing techniques spurred new kinds of enhancements to the guitar's playing versatility. For example, guitar virtuosos of the 1970s and 1980s such as Steve Vai (who developed new tremolo and whammy bar techniques), Eddie Van Halen (who adopted an innovative fingerboard tapping technique), Yngwie Malmsteen (who fused classical music with hard rock through a new approach to the electric guitar), Paul Gilbert (who developed a string skipped arpeggio technique and seamlessly combined fast and melodic playing), and Joe Satriani (who implemented complex chord progressions and stretches), would further evolve rock guitar playing and the need for new learning tools and pedagogies (Edwards, 2009; Ingram, 2010; Millard, 2004; Waksman, 2001; Weinstein, 2013).

Learning to play electric guitar during the latter half of the XX century shifted past the formal pedagogical approaches of classical and jazz guitar

that was practiced in many university music programs and conservatories (Carfoot, 2006). This was due to new methods for informal guitar learning that would include new media and technologies (Carfoot, 2006). Moreover, new electric guitar makers emerged resulting in "mom and pop" music shops offering private lessons for the classical, acoustic, and electric guitar (Guest-Scott, 2008). Though private lessons at local music shops were quite popular, formal lessons did not accommodate every novice who wanted to play the guitar for various reasons, including lack of economic resources or geographical location.

Major music publishers such as Mel-Bay and Hal Leonard published a variety of books that taught how to play the guitar by using standard music notation or tablature (fifteesrebel, 2011). Learning through guitar tablature was often favored by many non-traditional and novice players because it was simpler to understand. Unlike standard music notation, guitar tablature is laid out with six lines representing each string with the lower register (low E string) at the bottom and the higher register (high E string) at the top. Tracing its roots to the early European lute tablature of the Renaissance, tablatures are written out in sequence with the fret number repeated as many times as it is picked (Dalitz & Pranzas, 2009). As opposed to traditional music notation, combining guitar tablature with listening to the recording decreased the learning time and allowed a larger number of aspiring guitarists to learn their favorite songs (J. Schwartz, 1993).

In addition to published "how to" guides and "songbooks," an expanding outlet for informal guitar learning were guitar magazines (Theberge, 1991). Guitar magazines had a dynamic distribution across the United States and in Europe, to be found at most periodical stands, groceries, or convenience stores (Theberge, 1991). In 1967, *Guitar Player Magazine* made its debut focusing on popular music styles of the time such as the blues, jazz, and rock. Known for its versatility regarding artist interviews, each issue contained information that would set the foundation for guitar magazines that followed. To accommodate players with both formal and informal music backgrounds, every lesson within each issue was presented in both traditional music notation and tablature. In the 1980s, an age of guitar virtuosos, hard rock, and heavy metal popularized by Music Television (MTV), *Guitar World Magazine* (1980), *Guitar for the Practicing Musician Magazine* (1982), and *Guitarist Magazine* (1984) were founded, and all of them contained instructional materials similar to those published in *Guitar Player* (Coelho, 2003; J. Schwartz, 1993; Tandt, 2004; Theberge, 1991).

*Guitar World* and *Guitarist* featured more than just standard artist interviews and included reviews of the latest guitar technologies. As the videocassette recorder (VCR) became widespread in the 1980s, *Guitarist Magazine* began to release VHS tapes containing instructional guitar videos mixed with product reviews (J. Schwartz, 1993; Tandt, 2004; Theberge, 1991). This was around the same time that REH Video, Hot Licks, Homespun, and other music media publishers were releasing instructional videos of well-known guitarists of

the era (J. Schwartz, 1993). In the 1990s, the emergence of the Internet would soon take these learning resources online, while *Guitar World* magazine would continue to include instructional videos as DVDs with their printed issues (J. Schwartz, 1993; Tandt, 2004; Theberge, 1991).

In his book titled "The Age of Extremes: The Short Twentieth Century, 1914-1991," British historian Hobsbawm (1996) makes the augment that the XX century ended in 1991 with the dissolution of the Soviet Union, which incidentally coincides with the year that the World Wide Web was introduced to the public in the United States. This momentous innovation would symbolically mark the end of the XX century bringing about the XXI century and a new era for technology-mediated guitar learning, as discussed in the following section.

## XXI Century Technology-Mediated Guitar Learning

### The World Wide Web

Starting in 1991, the World Wide Web became a new outlet for guitar learning for a broad audience of traditional and non-traditional learners. Nevertheless, formal music programs and informal learning through guitar magazines, books, and DVDs carried over. With advancements in broadband connectivity and the introduction of new services and technologies, guitarists would find new resources for learning and playing the instrument in online archives and communities (e.g., *OLGA*), social media (e.g., *YouTube*), apps, software, and subscription-based services (e.g., *Pocket* Guitar, *GarageBand*, and *Yousician*), augmented reality (e.g., *Fretlight*), virtual worlds (e.g., *SecondLife*), and digital games (e.g., *Guitar Hero*).

### Online Archives and Communities

The term "online community" can be associated with any group of users interacting online on discussion forums, chat rooms, listservs, bulletin boards, or through instant messaging (Preece, Maloney-Krichmar, & Abras, 2003). By the mid-1990s, the Internet became a hotspot for musicians to buy, sell, and trade instruments, learn more about their favorite artists, find guitar tablatures for songs they wanted to learn, as well as join guitar-related online communities (Sprei, 1995). The Internet gave these musicians the tools to engage with other people who shared similar interests in ways that would not be possible off-line (Crozier, 1997; Hargreaves, Marshall, & North, 2003; Ruthmann & Hebert, 2012; Salavuo, 2006). Moreover, online music communities provided musicians with an outlet to discuss music-related topics, distribute original music, exchange learning techniques, and foster social interaction in online communities (Salavuo, 2006).

In his article published in *Guitar Player* magazine, Sprei (1995) discussed the impact that the Internet had on popular music through online guitar communities. During the early years of the World Wide Web, many well-

known guitarists such as Allan Holdsworth created Web pages that contained guitar tunings, FAQs, biographical information, and even audio and video recordings available for download (Sprei, 1995). The personal computer (PC) and the Internet became a meeting and learning place for musicians, changing the way they socialized and learned from each other. In 1992, James Bender established the "Online Guitar Archive" (OLGA) that would later become Harmony Central (Bessen & Maskin, 1997). Originally hosted by the University of Nevada at Las Vegas, OLGA was a very popular archive averaging around 200,000 guitar tab downloads per week. Considered as the first online guitar community on the web, OLGA provided guitar players lessons and access to an archive of over 15,000 guitar tablatures submitted by users (Bessen & Maskin, 1997).

In 1996, Eugeney Naidenov, an economics major at the University of Kaliningrad, compiled a collection of guitar tablatures creating "Zapp's Guitar Archive" (Music Trades, 2011). Naidenov accumulated and made available on the Internet hundreds of songs that were hard to find as printed sheet music or guitar tablatures in Russia. Due to online guitar communities like OLGA (United States) and later "Zapp's Guitar Archive" (Russia), guitarists were able to obtain tablatures and information about the guitar and guitar playing from anywhere in the world (Bessen, & Maskin, 1997). Moving forward, in 2002, Naidenov registered the "Ultimate-Guitar.com" domain name to expand "Zapp's Guitar Archive" by securing rights to a broad range of guitar tablatures from Alfred Publishing, EMI Publishing, Sony Music, and others (Music Trades, 2011). The "Ultimate-Guitar.com" website, which started as a depot for guitar tablatures, evolved into one of the largest online guitar communities with forums and chat rooms for players and enthusiasts. The expansion of this platform would continue due in part to the development of the "Ultimate-Guitar.com" app in 2010 which allowed users to access the site's content directly on smartphones and tablets (Music Trades, 2011).

Salavuo's (2006) and Waldron's (2009) studies show that online communities can be suitable spaces for socialization, learning, and sharing. Salavuo (2006) set out to investigate the reasons for member participation in an online music community. The findings of the study show that participants valued the social interactions and connections they made within the community. Nevertheless, participants had initially joined the community primarily for music-related reasons, rather than to socialize In another study, Waldron (2009) employed Wenger's (1998) framework to explore music learning in a virtual community of practice. The aim of Wenger's study was to gain deeper understandings of how teaching and learning take place within online music communities. The findings of the study suggest that meaningful music learning experiences occur through a variety of social interactions such as using and adapting the technology for individual music learning, sharing resources, seeking feedback, as well as asking and answering questions (Waldron, 2009).

**Social Media**

As online guitar communities continued to attract users worldwide, social networking and sharing spaces such as *MySpace* (2003), *Facebook* (2004), *Flickr* (2004), *YouTube* (2005), *Twitter* (2006), *Instagram* (2010), and *Snapchat* (2011) presented new opportunities for musicians to interact with one another (Albert, 2015; Salavuo, 2008). Currently, guitar magazines (e.g., *Guitar Player, Guitar World, Guitarist*), guitar manufactures (e.g., *B.C. Rich, ESP, Ibanez*), music retailers (e.g., *Guitar Center, Musician's Friend, Sam Ash Music*), and guitar enthusiast groups (e.g., *Guitar Tutorials*) have *Facebook* pages and *Twitter* accounts where musicians and guitarists can interact, pose and answer questions, and share resources and information. Although not originally intended as spaces for learning, these outlets can be used to learn about music (Albert, 2015). For example, social networking sites can make one's musicianship visible to others, which can form one's foundation for growth as a musician, encourage new collaborations, and foster lifelong learning (Salavuo, 2008). Furthermore, music educators can use social networking sites such as *Facebook Groups*, *Google Classroom*, or *Edmodo* to teach music (Albert, 2015) by posting audiovisual content to demonstrate musical concepts, interact with students, or create spaces for peer-to-peer interaction.

Launched in 2005, YouTube is a video sharing and social media website that revolutionized how people learn and teach guitar (Owings, 2016). This platform provides features that can facilitate guitar learning, such as the ability to pause, stop, rewind, and fast-forward to specific parts of a video (Hong et al., 2016; Kruse & Veblen, 2012). Furthermore, *YouTube* videos can be slowed-down, which can help learning fast or complex pieces of music.

The videos shared on *YouTube* can increase learners' interest (Rahmaturrizki & Sukmayadi, 2021), promote a participatory culture among music players and enthusiasts (Waldron, 2012), and even turn an amateur musician into a teacher-celebrity in a relatively short amount of time (Cayari, 2011). There are many musicians who started on *YouTube* and reached a teacher-celebrity status, and many of them are guitarists and guitar enthusiasts (Marone & Rodriguez, 2019). This is largely due to *YouTube*'s ability to provide these teacher-musicians with an outlet to a global audience and opportunities for instant feedback on their content (Cayari, 2011).

Kruse and Veblen (2012) consider *YouTube* as a suitable technology-mediated environment for learning to play the guitar. Their study examined videos from five traditional folk music websites, which not only included the guitar but also other traditional folk instruments such as the fiddle, banjo, and mandolin. The videos analyzed by these authors were primarily geared towards beginners and displayed various forms of technique-based instruction, psychological prompts, and aural support for the development of basic guitar skills. Similarly, focusing their investigation on the "Guitar Class of Uncle Ma" (a popular Taiwanese *YouTube* channel for learning the guitar), Hong et al. (2016)

explored the benefits of learning to play guitar while using videos found on *YouTube*. As reported by the authors, one of the main perceived benefits of the platform was the immediate availability of videos on-demand, which may be beneficial for all learners, and especially those who want to acquire basic guitar skills before committing to more extensive (and expensive) courses. Both studies show that *YouTube* can be an effective online environment for those who wish to learn the guitar (Hong et al., 2016; Kruse & Veblen 2012).

### Apps, Software, and Subscription-Based Services

Guitarists' common tools such as the tuner and the metronome are important technologies for supporting guitar learning. However, there are other technologies that can help learn playing the instrument. Many of these technologies emerged in the last 30 years due in part to the Internet and the introduction and diffusion of mobile devices. In recent years, smartphones and tablets have become increasingly popular with thousands of dedicated apps for guitar players, guitar learners, and musicians. In this context, Gouzouasis and Bakan (2011, pp. 3-4) examined a selection of apps for guitarists. Some examples are *Pocket Guitar, Guitar Toolkit*, and *Tab Toolkit* that offer guitar-like fingerboards for finger placement, chord learning, and basic tools such as a guitar tuner and metronome. In addition, *Chordplay, Chordmaster, Guitar Lab*, and *iReal b* offer similar learning opportunities with extended access to chords, accompaniments, and sound libraries.

Besides these apps, the diffusion of free and low-cost Digital Audio Workstations (DAWs) like *GarageBand* allowed music students and musicians to record and share their performances through computers, smartphones, and tablets (Sabet, 2020). Some DAWs like *Ableton Live* feature algorithms that allow users to "stretch" (i.e., slow down or speed up) recordings, which can facilitate guitar practice and learning of intricate pieces.

In addition, music apps and software, as well as subscription-based online guitar learning apps and services, allow self-directed learners to find free or relatively inexpensive resources for learning to play the guitar. These services are scarcely discussed in academic literature and include *Fender Play* (www.fender.com/play), *Yousician* (www.yousician.com), and *MasterClass* (www.masterclass.com), the latter featuring popular guitarists like Carlos Santana and Tom Morello as instructors. These services offer varying levels of interactivity and topics, from game-like experiences that focus on practice and technique development (*Yousician*) to more traditional videos that embrace a holistic approach to understanding and learning the instrument (*MasterClass*). Another salient feature of these apps and services is their connection to popular music and culture. For example, the *Solfeg.io* (www.solfeg.io) app includes songs from popular artists like Dua Lipa, Justin Bieber, and The Weeknd, which can engage students by allowing them to practice their favorite songs and helping them discover how music works (Kazaka & Vilde, 2021).

### Augmented Reality

Another technology-mediated approach to guitar teaching and learning is augmented reality (Martin-Gutierrez et al., 2020). An example of this approach is represented by the *Fretlight* (www.fretlight.com) guitar system (Optek Systems, Inc.), which utilizes an LED circuit board embedded underneath the guitar fretboard (Keebler, Wiltshire, Smith, & Fiore, 2013). The LEDs show learners where to place their fingers in sync with songs, riffs, chords, and scales. The system requires a specialized *Fretlight* guitar (www.fretlight.com) that connects to either computer software or a mobile app. The *Fretlight* is considered to be an "augmented reality" guitar system, which Keebler et al. (2013) defined as "the mixing of the physical world with digital information" (p. 172). In their study, Keebler et al. (2014) compared the accuracy of the *Fretlight* system to a traditional scale diagram guitar learning aid for learning the A minor pentatonic scale. Results from the study show that participants who were given the *Fretlight* instrument, compared to those who practiced with the traditional scale diagram, had a better retention of the scale (Keebler et al., 2014). A similar system to the *Fretlight* is the *Fret Zealot* (www.fretzealot.com), which uses the same LED concept through attachable LED strips that can be placed on any guitar.

### Virtual Worlds

Virtual worlds such as *Second Life* (developed by Linden Labs in 2003) feature a large number of musicians engaged in virtual live performances, social interaction, and sharing of musical ideas (Sant, 2009). Unlike digital games, which usually have stock characters and settings, *Second Life* allows its users to create most of the virtual world, including avatars, islands, and events. An example of music learning in *Second Life* is the Music Academy (2007), whose mission is to offer music appreciation education and promotion for composers in *Second Life*. Within this space, users can chat with music educators and even take musical instrument lessons (Sant, 2009).

### Digital Games

Digital games designed for learning can be traced back to the 1980s when computers started to become more common in homes and schools (Whitton, 2014). Digital games for learning have increasingly become more social as technology and the Internet have evolved, giving way to networked games that support collaborative activities (Whitton, 2014). In the context of music learning, digital games can increase student interest, as in the case of *Rhythm Heaven Fever* (released in 2012 for the Nintendo Wii game console), which teaches and assesses rhythm skills and concepts (Reyher, 2014). Music video games such as *Rhythm Heaven Fever,* although intended for entertainment, can serve a pedagogical purpose by teaching players important music skills that include syncopation, steady beat, tempo changes, rhythmic echoing, and the identification of different

music styles and genres (Reyher, 2014). These games can be used by teachers in school and outside of school as interactive media that initiate or complement formal music instruction.

In their earliest form, guitar-oriented digital games offered players a limited experience, if compared to playing the traditional instrument (Biamonte, 2011). *Guitar Hero* was the first game in this genre, allowing users to simulate a guitar performance by playing popular songs through a dedicated controller (Arnseth, 2006; Biamonte, 2011). Players interact with the game by using a guitar-like controller that has a lever for right-hand strumming and a series of colored buttons on the neck that allow players to perform along with a song, trying to match the sequence at the right time, as displayed on screen (Biamonte, 2011; Ramler & Chapman, 2011).

Soon to follow, *Rock Band* was released by Harmonics in 2007 and broadened instrument choice by adding controllers inspired by bass guitar and drums, as well as a microphone (Arnseth, 2006; Biamonte, 2011). Since its introduction, the *Rock Band* series has had several releases with the latest being *Rock Band 4* in 2015 and *Rock Band VR* (developed for the Oculus VR virtual reality system) in 2017. A key feature to the *Rock Band* series is that it allows collaboration with other players as they perform songs together in a band-like experience (Miller, 2009; Tanenbaum & Bizzocchi, 2009).

Through an ethnographic approach, Miller (2009) examined both *Guitar Hero* and *Rock Band* as games that enable participatory and collaborative gameplay. The author analyzed media debates about the games' impact, how they relate to models of rock heroism, rock authenticity, genuine musicality, and gendered performance conventions. The findings of the study questioned whether both games actually perpetuate and accurately simulate real performance on the guitar, drums, vocals, and as a rock group. Considering that these games offer a new kind of musical experience, the participants in the study did not acknowledge if these experiences were compelling enough for them to become motivated to learn the corresponding traditional instruments. Despite these findings, both games offer playful opportunities for musical collaboration, as well as social, mental, and physical engagement (Miller, 2009).

Digital games like *Guitar Hero* and *Rock Band* were not originally intended to be educational tools, but they still present potential for music learning. For instance, both these games may assist players with learning musical concepts such as eye-hand coordination, listening skills, and rhythm (Criswell, 2009). Moreover, both of these playful platforms provide unique forms of interactive participation and learning about musical concepts in a social environment.

In 2011, the French gaming company Ubisoft introduced *Rocksmith*, which resulted in a generational leap in the genre, by replacing guitar-like plastic controllers with traditional electric guitars as input devices and controllers

connected to the gaming console through a proprietary USB adapter (referred to as the "Hercules" cable) (Graham & Schofield, 2018).

Rocksmith (Ubisoft, 2011), Rocksmith 2014 Edition (Ubisoft, 2014), and its successor Rocksmith 2014 Edition Remastered (Ubisoft, 2016) are interactive digital games for the Sony PlayStation 4 (PS4) game console. The remastered version released in October 2016 contains new features, such as improved menus, customizable learning curves, stat tracking, expanded practice tools, bonus songs, and more. Ubisoft provided owners of the original edition the same updates included in the remastered version, with the exception of the bonus songs.

Rocksmith 2014 Edition Remastered offers three distinct paths for learning: (1) lead guitar, (2) rhythm guitar, and (3) bass guitar. One of the major enhancements of the 2014 Edition over the original version is that it allows players the ability to set song difficulty, where in the original Rocksmith, all players started at the lowest difficulty level and had to work their way up. Rocksmith 2014 Edition Remastered includes a session mode, which enables more experienced players to play along with in-game musicians for virtual jam sessions. The game also features a master mode that assists with playing a particular song by memory and introduces minigames through a feature called "Guitarcade" that challenges and trains players in areas they want to improve. In addition, Rocksmith 2014 Edition Remastered, which has over eighty-five lessons that cover a variety of skills and techniques, also features a new mode that assists colorblind players (Graham & Schofield, 2018). Compared to Guitar Hero and Rockband, which are considered games for entertainment, the Rocksmith series was not intended by Ubisoft to be exclusively a game but also an educational tool for players seeking to learn how to play the guitar.

Graham and Schofield (2018) investigated the effectiveness of Rocksmith as a learning tool. Specifically, their focus was assessing whether people could actually learn to play the guitar by playing the game. They report that very few studies present empirical evidence to support the claims made by the gaming company (Ubisoft) regarding learning to play the guitar in 60 days. Two experiments over a one-year period were performed to collect data on: (1) Rocksmith's effectiveness as a learning tool, (2) its learning mechanisms, and (3) player expectations of the game. The first experimental study focused on Rocksmith as a learning tool, while the second centered on how the game was utilized by players.

The participants in Graham and Schofield's first study felt they learned skills associated with playing the guitar, which focused on the game as a learning tool, rather than a game for entertainment. However, findings from the second study show that users tended to utilize Rocksmith predominantly as a video game, rather than a learning tool. Data collection for the second study took place over a longer period of time in comparison to the first study, which, according to the authors, allowed for more accurate observations. Overall, Graham and Schofield (2018) report that participants' perceptions of the game aligned with

the idea that *Rocksmith* is a great practicing tool that "shouldn't replace the teacher" (p. 78). Despite these contrasting findings and participants who reported frustration due to technical glitches many felt that the game was beneficial, entertaining, and fun. These findings, compared to those from an earlier exploratory study conducted by Jenson, De Castell, Muehrer, & Droumeva (2016), seem to confirm *Rocksmith*'s potential as a learning tool, which is also reflected by users' multimodal interactions in online communities dedicated to the game (Rodriguez & Marone, 2020).

**Conclusion**

Learning to play the guitar has been traditionally associated with a mixture of both formal and non-formal pedagogical approaches. Across the centuries, access to formal guitar training was not available to all guitar learners. Furthermore, approaches to learning how to play the instrument varied depending on the type of guitar and the style of music.

As the guitar evolved, so did musical styles alongside with it, which, in turn, influenced the approaches taken to teaching and learning how to play the instrument. The acoustic guitar, highly favored by immigrants with no formal music training coming to the United States in the latter part of the nineteenth century, has been related to informal approaches to guitar learning. Similarly, players of the early grassroots and delta blues movements learned to play the guitar through either self-taught methods or from other players, due to lack of access to formal music education. The birth of the electric guitar and the evolution of print and digital media (e.g., guitar magazines, tablatures, instructional videotapes) contributed to the popularization of the instrument across different social groups and musical styles. The introduction and diffusion of the Internet further broadened players' opportunities to learn the guitar. The onset of online guitar communities provided spaces for guitarists from around the world to gather, share resources, collaborate, and learn from one another. Further, social media like *YouTube* provided guitarists with opportunities to learn to play the instrument for free and at their own pace. However, there is still a lack of research on how online and offline music communities integrate, converge, and overlap with one another (Waldron, 2012).The pedagogic potential of apps, software, subscription-based services, augmented reality, and virtual worlds has still to be fully explored.

Digital games such as *Guitar Hero* and *Rock Band* introduced players to guitar-like experiences through game controllers that allowed them to get familiar with basic musical concepts. These games created new modes of musicality that can foster personally and socially meaningful musical experiences for the players. *Rocksmith* expanded these possibilities by enabling players to use an electric guitar as an input device and controller, which has the potential to facilitate the transfer of guitar skills built by playing the game to playing the instrument in the real world. The continuing evolution of technology-mediated and playful approaches

to learning how to play the guitar, and the related online communities, can support learners who do not have access to formal music education, or who prefer alternative, social, or self-directed forms of learning.

In conclusion, history teaches us that guitar learning, pedagogy, and technology evolve with and are influenced by emerging musical genres, playing styles, and techniques. These evolutionary cross-influences often originate from bottom-up, popular, and non-traditional sources, and they will likely continue to trace paths of innovation and disruption for years to come.

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