Feedback in instrumental music practice: The missing link

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Abstract

Feedback is an important yet often overlooked mechanism within instrumental music practice. It is found in all stages of the practice cycle (Charness et al., 2014; Ericsson, 1997; Jørgensen, 1997) and is considered a key factor in the success or failure of the music learner (Hallam, 1997b). Much of the early research on feedback in music practice was based on practical aspects of playing such as correcting technique (Salzberg & Salzberg, 2016), or providing an enhanced feedback mechanism using technological interventions (Schwaegler, 1984; Tucker et al., 1977). Key research since this time has focused on three main settings within the music learning environment: teacher behaviour in the classroom or applied studio setting, peer and student feedback in assessments, and sensory feedback in the performance of music (Parkes, 2018). A recurring theme in the literature is the issue of engagement and motivation during practice (McPherson, 2000). However, there has been little research on what constitutes effective feedback from teachers during lessons, how young, novice and high school students acquire and receive feedback during their individual practice sessions outside of lessons, how novice musicians utilise sensory feedback, and how feedback can impact the engagement and motivation of students during practice.

To help bridge this research gap, we can look towards existing literature on feedback in the education and psychology domains. In recent years, there has been a shift from feedback as something given to students towards feedback as a process in which students are actively

involved (Dawson et al., 2019). Feedback is a learning tool that helps novices with difficulties in understanding the performance goal and in evaluating how their own performance matches to the goal, by correcting these discrepancies and changing their behaviour. For many novice instrumental music learners, a reference point in the form of external feedback is needed so that they can develop the accuracy in their own self-evaluation to better judge the quality of their performance. In time, learners will develop the ability to self-evaluate their own performance and monitor their own engagement in tasks. The notion that students are actors in the feedback process is largely absent in the music education literature.

This paper aims to explore the existing literature on music practice, feedback, and feedback technologies with a focus on how technology can provide effective feedback to instrumental music learners to aid them in practicing effectively as well as enhancing their motivation to learn.

Keywords

Music practice, feedback, self-regulated learning, music technology, music practice tools, music learning applications.

Music Practice

Instrumental music practice is a widely researched topic in the field of music education. In a recent article by How et al. (2021), there has been a strong growth of research in this area in the last decade, in particular in the United States, the United Kingdom and in Australia. The focus of the research has been on the psychology in music practice, with a focus on deliberate practice, self-regulated learning, and motivation, across three main settings within the music learning environment: teacher behaviour in the classroom or applied studio setting, peer and

student feedback in assessments, and sensory feedback in the performance of music (Parkes, 2018).

Music practice habits have been researched widely (Barry & McArthur, 2016; Hallam, 1997a; Hatfield, 2017; McPherson et al., 2017; Miksza, 2006, 2007; P. Miksza, 2011; Miksza, 2016a, 2016b; O'Neill, 1997; Pike, 2017; Sandgren, 2018) (Zhukov, 2005) as has music and self-regulated learning (Boucher et al., 2017; dos Santos, 2018; Dos Santos & Gerling, 2011; Hatfield, 2016; Hatfield et al., 2016; Kim, 2010; McPherson et al., 2017; Mieder & Bugos, 2017; Miksza, 2011; P. Miksza, 2011; Miksza, Blackwell, et al., 2018; Miksza, McPherson, et al., 2018; Nielsen, 2001, 2004, 2011, 2015; Osborne et al., 2020; Özmentes, 2008; Rita Mangione & Andrea Ludovico, 2014; Ritchie & Williamon, 2012).

Effective music practice is not so much based on talent but rather on time and effort invested into the process which is founded on clear goals, self-monitoring, repetition, error correction, and feedback (Varela et al., 2014). Music practice is an intricate process commencing in the music lesson where repertoire and musical skills are taught by the teacher, as well as modelling of how music practice should be done occurs. From here, the student will practice in between lessons, usually at home. Success with home practice will depend on whether the student has understood and remembered what was taught in the lesson, the types of practice strategies they use according to their level of ability (Hallam, 1997b), and factors affecting their practice environment such as where they physically practice but also the level of parental support (Creech, 2006, 2010, 2016; Davidson et al., 1995; Ericsson, 1997; Evans & McPherson, 2014; Hallam, 1997a, 1997b; Hallam et al., 2012; Huber, 2019; McPherson, 2008; McPherson et al., 2015; Pitts et al., 2000; Sloboda & Howe, 1991; Upitis et al., 2016; Youm, 2013; Zdzinski, 1996). Self-regulated learning is fundamental in how well students

practice outside of their lessons, with a substantial amount of research in this area showing a strong correlation between high academic and music performance, motivation and the use of self-regulation strategies (Varela et al., 2014).

Whilst most of the research over the last twenty to thirty years has investigated practice habits, strategies, and self-regulated learning to better understand and conceptualise effective music practice, the research still is yet to find a prescriptive model for effective practice. One important dimension of music practice is feedback; however, there is very little research on what constitutes effective feedback in the field of instrumental music practice.

Finally, technology can assist with effective music practice. However, existing applications have not been studied to see whether they can assist with effective music practice nor with helping students develop good practice habits, strategies and becoming self-regulated learners.

Feedback

There are many different definitions of feedback. In the context of education, feedback is an interactive process of communication whereby a learner is given information on the accuracy of, or insight into a performance (Clynes & Raftery, 2008; Molloy & Boud, 2014; Mory, 2004). Feedback involves practice of a task, where an actual performance is compared with a some standard of performance (Johnson & Johnson, 1993). Feedback can be in the form of both qualitative information, information regarding accuracy of the performance and the degree of discrepancy between the person's performance and the correct performance, and quantitative information, the size of the discrepancy (Johnson & Johnson, 1993). Qualitative

feedback helps individuals improve their performance, whereas quantitative feedback promotes achievement more effectively (Anderson et al., 1979).

Feedback "can come from almost anywhere" (Duke, 2005, p. 124), which is definitely true in music learning, where three key sources of feedback occur in the learning process: feedback from oneself, feedback from others including the teacher or parent, and technology-assisted feedback (Johnson & Johnson, 1993). Here, feedback is defined as a system used to make adjustments to reach a goal. Feedback is a learning tool that helps novices with difficulties in understanding the performance goal and in evaluating how their own performance matches the goal.

Traditionally, feedback is viewed as individual episodes where teachers tell learners about their performance (Molloy & Boud, 2014). This is true in the context of instrumental music, where feedback is often given only during lessons or after performances and music examinations (Parkes, 2018). In this research, it will be suggested that a constructivist view of feedback should be considered in developing a comprehensive feedback system that enhances instrumental music learning and the motivation to learn an instrument. The current literature suggests that feedback needs to be student-centric and learner-focused and should be viewed as a system of learning where learners can engage in feedback episodes, alter behaviour based on the provided feedback and evaluate their performance in relation to their learning goals (Molloy & Boud, 2014; Mory, 2004).

Following a constructivist viewpoint, feedback helps the learner to correct these discrepancies and change their behaviour. For learners who have a clear grasp of the goal, self-evaluation of the performance is fairly accurate. However, for many others, in particular, novice

instrumental music learners, a reference point in the form of external feedback is needed so that they can develop the accuracy in their own self-evaluation to better judge the quality of their performance (Molloy & Boud, 2014). In time, learners will develop the ability to self-evaluate their own performance and monitor their own engagement in tasks. The notion that students are actors in the feedback process through practices such as feedback-seeking are relatively scarce in the feedback literature and largely absent in the music education literature.

In music education, feedback is not formally defined, but has been studied in terms of teacher behaviour in instructional settings predominantly the music classroom (Parkes, 2018). This definition presents somewhat of a behaviourist view of feedback, where feedback is an external transmission of information (Molloy & Boud, 2014). This view focuses on enhancing the teacher's capacity to deliver feedback through high quality information, which is what most of the existing literature is focused on. However, the literature is limited at exploring the role of the student in feedback in music practice beyond peer and self-assessment, or as part of sensory feedback as musicians actively listen to themselves during their own musical performance (Parkes, 2018). What other sources of feedback impact the student's learning in music tuition and practice is largely unexplored.

Technology

Technology in Music Practice

In considering technological applications in music practice and education feedback, there are a broad range of music learning applications for classroom teaching (Kim, 2013), however, there are a limited number of specific music practice applications (Wan & Gregory, 2018), none of which have been studied to determine whether they promote effective feedback in music practice nor whether they improve student motivation. Previous research categorises

existing digital music practice tools into five categories: practice log tools, note feedback tools, music practice tools, sheet music tools and accompaniment tools (Wan & Gregory, 2018).

Practice Log Tools

These tools enable students to track their music practice by entering goals and logging their practice against those goals. Applications include *PracticeBuddy, MusicPractice, MusicJournal, PracticeMusic, Instrumentive, Music Practice Log, Sessions: Music Practice Log, Music Practice App* and *MyTractice.*

Note Feedback Tools

These tools detect and indicate whether the notes of a piece have been played at the correct pitch and rhythm. Existing applications include *Interactive Pyware Assessment System (iPAS), SmartMusic, MatchMySound, PlayPerfect* and *Music Prodigy.*

Music Practice Tools

iScore, now called *Cadenza Practice App,* is the only tool available for music practice. It aims to scaffold SRL during music practice through goal setting and reflection functionality. The application also provides teachers to annotate student's video recordings.

Sheet Music Tools

These are applications that allow students to interact digitally with sheet music. Applications include *Chromatik, AvidScorch, MusicReader* to create their personal sheet music library, listen to recordings, and annotate the music.

Accompaniment Tools

These applications allow students to play other parts whilst the student plays their individual part. Applications include *Meloflow, BandPad and iRealPro* to accompany students by simulating band sounds. *Meloflow and BandPad* use note-detection technology to follow the student on the score.

Other Music Learning Applications

In addition to these applications, digital metronomes, tuners and a wide range note reading apps are also utilised by students in music practice. There are also various existing applications such as *Auralia* and *AuralBook* that are used for ear-training. In a research context, motion capturing technology has also been used to capture and provide feedback on player's movements and posture. These include *i-Maestro, Elbow Piano* and *Digital Violin Tutor*, however, none of these applications took off commercially (Cheng, 2018).

One of the key shortcomings of the research in this area is that none of the commercial applications listed above have been studied in the music practice environment to see whether they are capable of enhancing instrumental music learning and promoting effective music practice. This is an area for further research.

Technology and Feedback

An important question is whether technology can assist in the effectively delivery of feedback, and if so, how. As identified above, technology can assist in processing data from feedback provided to students such as in error identification. In a study by Carless et al. (2011), participants identified the benefits of technology in facilitating the feedback process as technology can allow the student to better engage with the feedback than with conventional

verbal and written feedback, helping them engage in their own learning. This fits in the constructivist view where "the most effective feedback revolves around the students' need" (Carless et al., 2011, p. 402).

Deeva et al. (2021) suggest that an effective automated feedback system must comprise of four key aspects: architecture, feedback, the educational context, and evaluation. Architecture includes the algorithms and programming language used to house the system. This includes considering how the feedback will be deduced, what feedback needs to be provided, how and to whom does this feedback need to be provided and when does it need to be given? Data can be collected from domain knowledge which addresses what type of feedback is to be given, from expert knowledge which is information or data provided by teachers or frameworks that give guidance on rules that help map domain knowledge with student inputs, and from student data including learning analytics and identifying indicators to trigger the feedback. The types of data collected and used will depend on the type of student, the task, and the architecture of the system.

Technology can assist with the delivery of feedback. Technology can create conditions for innovative feedback practices (Dawson et al., 2019) and provide richer feedback through different types of media such as audio and video recordings which can better assist students in understanding the feedback (Henderson et al., 2019). Learning analytics (LA) can also provide us with insight into how students learn and the experiences they encounter with their learning (Dawson et al., 2014), enabling software designers to understand optimised learning processes (Pardo et al., 2019). LA can be collected through various types of technologies including computer assisted teaching (CATs) and intelligent tutoring systems (ITSs) (Karlsson et al., 2009; Pardo et al., 2019). This data can assist with student learning by

providing personalised feedback to students, whether this is done by the teacher accessing the data or provided by the system itself. In research conducted by Pardo et al. (2019), feedback resulting from LAs had a positive correlation with student satisfaction and academic performance. Furthermore, the research also highlights how teachers can use the data collected to tailor comments in providing high quality feedback.

Finally, as identified in Carless et al. (2011), technology can promote student autonomy and self-reflection. This can be done by creating a system in which the student can engage in active dialogue about their learning to raise awareness of the quality of their performance, assist them in monitoring and evaluating their own learning, and enhancing lifelong learning through the development of goal setting and planning of their learning (p. 405). Furthermore, technology can help overcome barriers students face to self-regulate their own learning without limiting the effectiveness of the feedback given.

Technology can really help effectively deliver feedback in instrumental music practice. In developing such a feedback system, a focus on ensuring that the feedback is rich and easy-to-understand is needed. This can be done through various sophisticated algorithms that can provide feedback on pitch, rhythm and general performance accuracy which can also be combined with other technological feedback such as goal setting and attainment, self-assessment or reflection, and the use of annotating video or audio performances. A second priority would be to focus on personalisation so that the feedback system is student orientated. This can be driven by data collected by the student as the student practices and then analysing the behaviours so that the system can adapt to their needs, goals, personality and learning characteristics (Deeva et al., 2021).

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