

The development of a smart phone application to allow self-regulated practice evaluation for musicians: A case study

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A project funded by the Arnold Bentley New Initiatives Fund (SEMPRE)

Abstract

Musical excellence demands deliberate, effortful and well-executed practice on a regular basis. To meet these demands, students are required to successfully implement self-sufficient practice strategies without the constant assistance of their teachers and peers. The main aim of this project was to develop a simple and user-friendly smart phone application that enables music students to document their individual practice habits. The application allows the student to record, monitor and evaluate their activities without too much interruption in their practice process. The following section will discuss the significance and development of this application in various as well as its evaluation with the help of a case study.

Keywords

Self-regulated learning; Smart phone application; Practice evaluation; Performance quality

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Introduction

Music making is an activity with high physical and mental demands that put musicians at risk in the execution of their art-form (Clark, Holmes, Feeley, & Redding, 2011). It is therefore increasingly important to recognize how musicians can maintain a healthy body and mind in order to secure a lengthy career and prevent physical and/or mental deterioration. A critical stage in a musician's development occurs during their time at a conservatoire or other institution where they are preparing to enter the profession. It is essential that, during this time in higher education, young musicians are prepared and learn about preventing injury. After all it has been shown that 'the success with which professional musicians tackle the challenges of their chosen occupation is likely to depend on the extent to which they take responsibility for their health and wellbeing and on the habits formed early in the course of their training' (Macdonald, Kreutz, & Mitchell, 2012). Sadly, the training and education of performers very often fails to incorporate advice to students on care of the body and prevention of injury (Parry, 2004). Fishbein (1988) for example found that 76 percent of a sample of 2212 musicians reported atleast one serious medical condition that affected their playing. Reasons for such alarming results have been attributed to multiple factors including excessive workloads, poor posture, lack of fitness and bad practice techniques. However through healthier working conditions and healthier practising habits many such problems can be avoided (Williamon & Thompson, 2006).

Addressing the issue of bad practice habits, this essay seeks to identify the potential benefits of the implementation of a user-friendly smart phone practice application that enables music students to plan, document and monitor their individual practice habits as to avoid the pitfall behaviours associated with practice such as over-practising. After an initial examination of what practice is and its challenges, there will be an analysis of good practice behaviours that should be encouraged to avoid injury. In light of this, the use of smart phone applications as way of helping individuals self- regulate certain behaviours, will be addressed in various domains highlighting the absence of such tools in the area of music. Implementation of a specially constructed smart phone application for musicians will then be described and evaluated with the help of a

case study of a violinist who has recently trialled the application. To conclude, a description of who should implement and sustain the use of the application will be considered.

Practice and challenges

'Practice isn't a forced labour'

– Yehudi Menuhin

A major facet of a musician's training includes their practice, the most prevalent activity that musicians engage with and unarguably a necessary duty (Lehmann, Sloboda, & Woody, 2007). According to Klickstein, practice involves a constellation of factors, which he divides into five zones: learning new material, developing material, performance material; technique (e.g. scales, etudes) and musicianship (e.g. improvisation, sight-reading). To make significant progress research suggests that consistent practice in all five zones is required (Klickstein, 2009). With such demands on a musician it is hardly surprising that practice often becomes overwhelming, causing musicians to exceed their physical limits in order to achieve their desired goals through over-practicing and/or bad practice habits. Despite a musician's best intentions to work effectively goals often become hazy, they get stuck on certain difficult sections in the music, don't recognise when they are too tired and therefore struggle to muster up the necessary attention/energy and often carry on regardless. This not only affects the effectiveness of the practice session but also puts the musician at risk of serious injury and fatigue.

Zaza et al. identify a number of sources related to practice and physical injury in musicians including: (i) changes in technique (ii) intense preparation for performance/auditions (iii) overly strenuous repetition (iv) sudden increases in playing intensity (v) preparation of new and challenging repertoire with unusual demands (vi) prolonged playing without adequate rest and (vii) lack of warm up (Zaza, 1997, Paull & Harrison 1997, Kella 1997). Guptill et al. (2000) and Spahn (2002) found that between 68-88% of music performance students

had suffered from health related problems during their pre-tertiary music training and 25% start their tertiary studies with health related problems. Clearly the act of practicing intensely over several years can have a profound effect on the human anatomy including musculature, bone structure, circulation and even the respiratory system (Parry, 2004). Whilst research has acknowledged that the duration of practice is important, it is still the quality of practice that remains central (Lehmann, Sloboda, & Woody, 2007).

In summary, if musicians refuse to acknowledge their physical and psychological limits, one is at serious risk of a number of problems. This is even more likely to occur to less – experienced musicians who might not appreciate the fact that sudden increases in playing time or lack of breaks wear them down and bring on injury (Klickstein, 2009). With this in mind, it is therefore crucial that conservatoires are encouraging students to establish healthy practice habits early on as to avoid unnecessary injury during their studies.

Healthy practice habits

“People take such wonderful care over their £10,000 flute or their £40,000 violin- they need to take care of their bodies in the same way”

- Richard Norris physician and flautist

Whilst musicians may be unable to influence what occurs at an ensemble level, they have complete control over their behaviour in individual practice sessions. For this reason, individual practice behaviours are an important target for preventative measures (Zaza, 1994). Given that research into music science is still relatively new, research from the areas of sports medicine, occupational medicine and arts medicine are often applied to the field of music performance. The following model pinpoints several protective factors for preventing, or at least reducing, risks to musicians during their practice time.



Figure 1. Good practice habits according to Zaza, 1994.

As explained earlier, practice is an effortful endeavour and the above factors, which have been explored in literature, have the potential to greatly reduce musculoskeletal symptoms and other injuries in musicians In the following ways:

- **Warm-up** – whilst neuromuscular warm- up is common in musicians (playing slowly to stimulate appropriate muscles and maximise the coordination and skill level), physical and more general warm-up is less common. It is suggested that gentle stretching increases body temperature and circulation and can reduce the risk of strains. It is important to note however, that stretches should be informed or guided as to avoid pain or injury (Zaza, 1991, 1994). Williamon & thompson study with music students identified lack of warm up as a major contributor to medical complaints (2006)
- **Breaks** -should be regular to avoid strain on load bearing muscles as well as those muscles used for fine motor actions. Studies have shown that breaks dissipate fatigue caused by massed practice (Stelmach, 1988 cited in Zaza 1994)
- **Pacing**- research has shown that spaced practice is better than massed practice which is associated with fatigue and inefficient learning . When

practice is paced, sudden increases in activity are reduced, and result in the less likely hood of the development of a musculoskeletal injury. This is particularly relevant in the lead up to a performance, audition.

- **Variety of content-** repetition of material has been identified as a risk factor amongst musicians developing an injury. It is therefore important that musicians vary/rotate activities.
- **Cognitive rehearsal-** practice can often lead to fatigue which results in playing mistakes and useless practice (Lehmann, Sloboda, & Woody, 2007). When a musician has physically played for some time the body maybe tired, especially if pain is present and may need a rest, however the brain may still be fresh therefore mental rehearsal maybe beneficial. Whilst research on the effectiveness of cognitive rehearsal is somewhat inconsistent in relation to performance skills (Connolly & Williamon, 2004), stepping away from the instrument and physical demands will inevitably reduce risk of injury.
- **Exercise-** this does not need to be extreme athletic exercise but physical activity may prevent against musculoskeletal injuries. This can include building up supportive muscle groups related to demands of specific instruments.
- **Anatomy of playing an instrument** – having a basic understanding of the anatomy of the body can alert musicians to the parts the body their particular instrument requires, as such affording them the ability to make informed judgements about possible strains and stresses. Given that musicians are also their own coaches for the majority of the time it will help them to separate out what advice is going to help or hinder them based on a basic knowledge of the body.
- **Management of stress and anxiety-** whilst the relationship between stress and anxiety on the presence of musculoskeletal symptoms has been somewhat unclear (e.g. Davies & Mangion, 2002; Leaver et al., 2011), a recent study from Kenny and Ackerman (2013) highlighted a correlation between PRMD severity ratings and increasing mean K-MPAI scores suggesting there is a relationship. Therefore techniques in dealing with stress should be available to students.

Various systems which help musicians adopt healthy practice behaviours already exist. For example, written diaries from Horsey and downloadable practice sheets, such as those designed by Klickstein (2009) (based on the five practice zones). However, such materials are time-consuming and require the student to print them out, have a pen or pencil to hand and then file them somewhere or have access to a PC. In contrast, a practice app exploits transportable technologies, which are already integrated into student life, and not only can an app perform all the tasks of other preexisting practice support systems, it also makes several additional options available. Furthermore, the app allows the student to record, monitor and evaluate their activities without too much interruption in their practice process. The app is also interactive in that it advises the student to carry out certain behaviours during their sessions such as taking breaks and warming up. The following section will discuss the significance and development of smartphone applications in various domains.

Smart phone applications and self-regulation

According to Hebden et al. (2012) across developing countries, the average person owns 1.18 mobile phones with this number continuing to rise. Much of this increase has been in smartphone ownership where there were more than 490 million shipments of smartphones globally in 2011 compared to 300 million in 2010. This growth has been concentrated mainly in young adults in their early twenties. The result of smartphone popularity has led to the proliferation of smartphone software in the form of applications (“apps”). Up until now apps have been designed in a variety of settings with the aim to help individuals form and maintain healthy behaviours in a novel way, reaching individuals en masse. In the clinical care setting apps have been designed to enhance the delivery of health behaviour change interventions where patients, with asthma or migraines for example, are able to monitor themselves (by keeping a diary of symptoms) and are afforded therapeutic feedback (advice/ instructions) via the application.

In the sport domain, apps like ‘Training peaks’ offers athletes the opportunity to structure, plan and analyse their training by measuring parameters, such as speed, power and heart rate. Moreover, the system provides the athletes with the option to synchronize diaries with their coaches, a tool which enables the coach to overlook training progress. On a commercial level, apps have been devised to assist weight loss with information on nutrition, physical activity and calorie counting, as seen in a recently developed app designed to assist young adults with improving their dietary habits (Hebden, Cook, Ploeg, & Allman-Farinelli, 2012). The app provided young people with a platform to create daily entries of their behaviors e.g. physical activities undertaken or healthy foods consumed from which they were then provided with weekly summaries of their reported behavior. This enabled them to subsequently monitor and plan around these behaviors and make adjustments where necessary. Apps of this kind have been shown to have the potential to improve population health, largely because of the widespread and increasing use of such dynamic technology and the potential to reduce intervention delivery costs. In terms of behavior change strategies, the above applications foster self-regulatory skills such as self-monitoring and planning, which according to Hebden et al., are both required to adopt and maintain healthy behaviors (Hebden, Cook, Ploeg, & Allman-Farinelli, 2012). Mullen and Suls claim that it is this self-attention that permits faster and more accurate assessment of ones own condition and therefore the taking of appropriate measures where necessary (Mullen and Suls 1982, cited in Macdonald, Kreutz & Mitchell, 2012).

Though it is clear that apps are accessible to the majority and have the potential to form healthy habits, there have been virtually no practical implications in the music domain. This seems surprising given two factors, firstly that performance students are reported to have greater self- efficacy (Schwarzer & Jerusalem 1995) and self-regulation (Schwarzer et al. 1999) than the general population and secondly that music teachers, including Galamian (1964), have suggested that it is convenient for students to view practising as a means of “self-teaching”. Considering these points, and building on the above rationale of healthy practice habits, the following practice application has been designed, to encourage music students to interact and reflect on their learning processes and

motivate them to adopt healthy practice strategies and troubleshoot the common problems associated with practice in a device that is easily accessible to musicians.

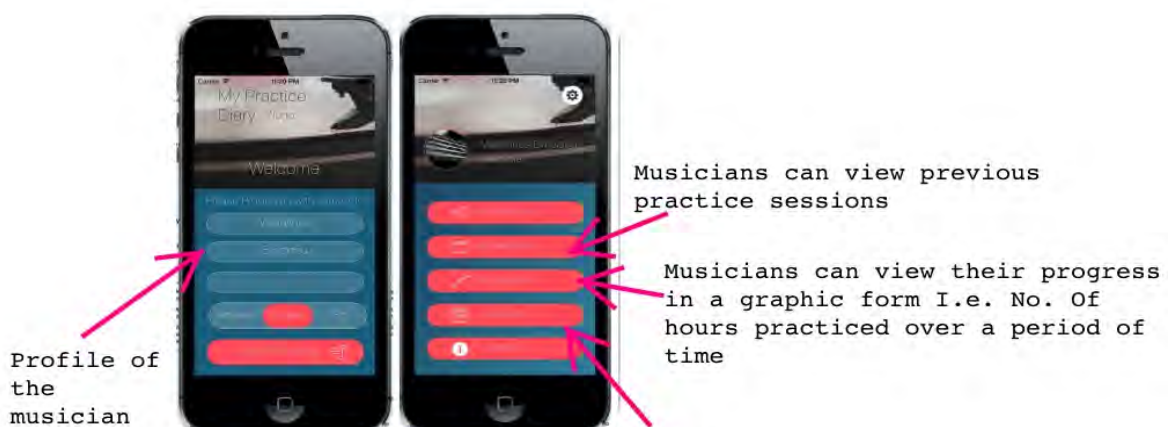
Implementation of a practice application for conservatoire musicians

'A well-crafted practice plan divides your material into viable units'

(Klickstein, 2009)

The application has three purposes: to encourage healthy habits through planning and monitoring practice; to dispel the culture of silence, often associated with injured musicians by providing a platform for anonymous communication; and finally to provide helpful information and advice via a blog. Screen shots taken from the application will now help explain the app and its benefits in more detail.

Once the application is downloaded and the consent has been signed, there will be a short introduction video about how to use the app. The musician will then be asked to provide details about their gender, instrument, years of musical practice, and email address for verification (Figure 2.). After the personal details have been entered the individual is able to select one of several modes: start practice, view previous practice sessions (they won't be able to view anything until they have used the app at least once), view their progress (after a few sessions), calendar (opportunity to **pace practice in relation to upcoming**



Calendar has the option to input auditions/performances/exams in different colors
Calendar also allows the student to plan practice sessions in relation to upcoming auditions and performances and set long, short and medium term goals

musical events i.e. auditions/concerts allowing individual to **set specific goals** and sessions over a period of time- hoped that it will alleviate elements of the 'unknown' through planning, which can often be associated with stress) and *finally retrieve information about the app.*

Figure 2. Screen shots once the app has been downloaded

When the musician selects 'start practice' they will be taken to the following screen (Figure 3.), but before being able to hit 'start' a pop-up speech bubble will appear asking them if they have warmed-up? This is implemented to **enhance proprioceptive skills** or body awareness and the importance of warming up before continuing with a practice session (the blog on the app provides specific warm up exercises specific to instruments types and the musician will be able to find one that suits them). They are then able to hit 'start' which sets off a timer, which records the duration, spent practicing. If at anytime during the session they take a break they can pause the timer. The end results will show the blocks of time they spent practicing and the length of breaks taken. The App promotes **taking breaks** during practice sessions by alerting the musician every 40 minutes to consider stopping and having a break/stretch/drink or food.

Every 40 minutes the app will alert the musician that they should take a break so that the individual doesn't get caught up in non- stop practice.

Before the musician is able to hit 'start' the app will ask the musician 'have you warmed up?' This is to encourage musicians to stretch before starting a session. Articles and information on appropriate warm ups will be included in the app blog



The individual hits 'start' when they commence their practice and hits 'pause' if they have a break this helps monitor time spent practicing and when students are taking breaks.

According to Ericsson and Lehmann, it is only possible to engage in such activities (practice) for limited amounts of time before rest and recuperation are needed' (Ericsson & Lehmann, 1999, p.695).

Figure 3. 'Start practice' screens

After finishing their practice session the musician will be asked to rate the session in terms of overall performance quality, efficiency and level of concentration from 1='Very poor' to 7='Excellent' (Figure 4.). Over a series of sessions it is hoped that by noting levels of the three characteristics mentioned above that students will acknowledge **when they work most effectively** i.e. mornings/evenings.



Figure 4. Overall evaluation of session

The musician will then be asked to provide more specific details about what they practiced i.e. scales/exercises/pieces and then how they allocated their time to each i.e. 30% scales 10% exercises and 60% pieces (Figure 5.). It is hoped that over time the individual will be able to see where they are allocating time in their practice and encourage them to **balance their practice and vary it** as to not get hung up on one particular activity which research has shown is a risk factor for injury. The musician will then be asked if they wish to specify particular activities i.e. what type of exercise or scale or what piece and by whom. This is followed by a rating score specific to the activity inviting the musician to self-evaluate each task/activity carried out in the session and how effective they felt they had been by, again, using a 7 Point Likert Scale (1='Very poor' to 7='Excellent'). They will finally be asked to input the intention for the task i.e. musical/technical or other where they can enter their own intent for the task. The programme, with the intention to avoid musicians having to enter information more than once, will save each specification.

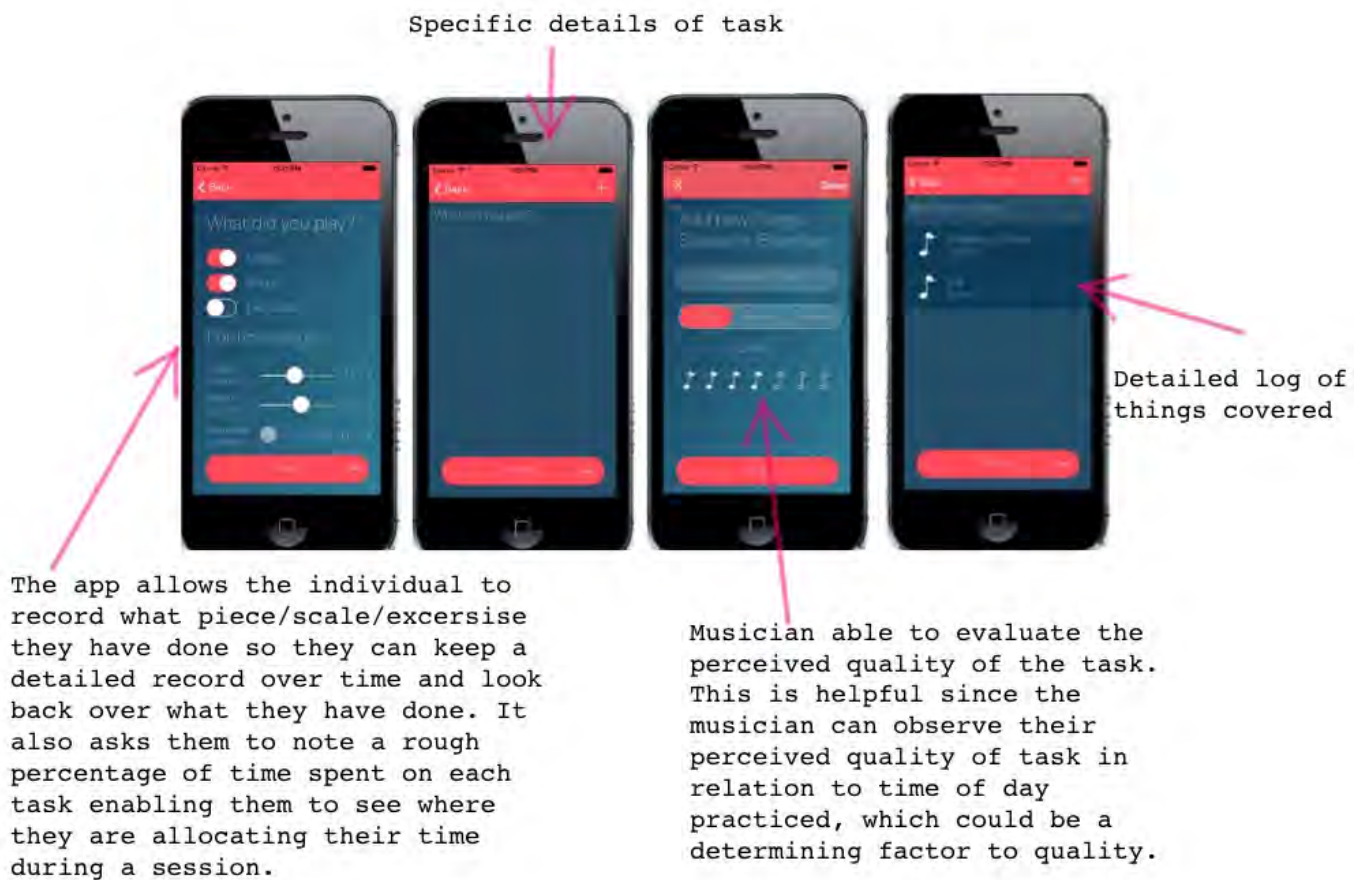


Figure 5. Details of activities

The result section aims to inform musicians about their practice habits through visual presentation of the entered data (Figure 6.).

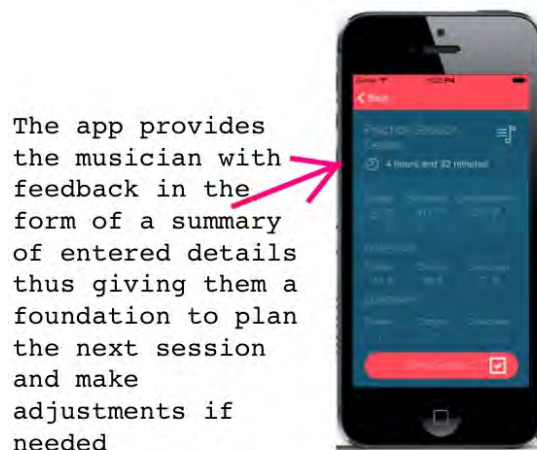


Figure 6. Feedback screen

In addition, the mobile application will provide the individual with the opportunity to share their data with others with the intention to **motivate and reinforce reflection on their own practice** (Figure 7.). Moreover, there will be an additional section providing relevant literature on self-regulated practice strategies, non-strenuous warm-ups, questions and answers as well as a blogging system, where musicians have the possibility to exchange thoughts and ideas on practice and encourage them to discuss incidents of injury anonymously. It is acknowledged that only a small number of musicians either discuss or seek specialist advice when they encounter physical problems (Kreutz, Ginsborg & Williamon 2008). It is possible that this is related to the traditional taboo of revealing weaknesses or fears in a competitive environment (Macdonald, Kreutz

and Mitchell, 2012). It is hoped that the app, and the option to share thoughts and ideas with other musicians anonymously on a blog, will go some way to encouraging musicians to share their experiences with each other and **develop solidarity amongst musicians** in order to dispel the taboo associated with injury and ‘weakness’.



The app allows musicians to share their practice activities with others on social media. It is hoped that musicians will also use it as a way to discuss difficulties and challenges faced during practice and begin to dispel culture of silence surrounding practice.

There will also be a blog with useful articles and advice to encourage healthy attitudes towards practice and maintaining a healthy body and mind

Figure 7. Social networking and sharing data/thoughts/ideas

Case study

The following case study looks at a violinist who has recently trialed the app and gave the following feedback:

“I use my phone all the time so using it to plan and evaluate my practice was really easy and convenient. I like to plan my practice because I avoid getting caught up in unnecessary tasks and also you avoid things like last minute panic practice which

causes a lot of stress and tension. Being able to plan in relation to future events also avoids unwarranted injury under time pressure. The apps feature that allows you to see your practice sessions made it easier for me to find out what worked best for me and helped me to observe when I focused best and when I am more productive to practice. You learn also to be realistic with your time in regards to your physical and psychological limits for example I am now aware of when I am very tired and my energy is low so I avoid practicing at these times as way of protecting my resources. I like to plan my practice also because its easier to maintain and stick to scheduled breaks as apposed to just continuing and forgetting how long you have been going and wearing yourself out”- Violinist

The above case study highlights several factors that suggest the app would be an excellent way to promote health and wellbeing among conservatoire students, including: reduction of mindless practice, avoidance of stressed/last minute practice, facility to plan in relation to other events, capacity to assess when is more effective to practice and encouragement of breaks.

The musician describes how the app was a handy way of monitoring practice as his phone is always on him and encouraged him to acknowledge certain behaviours, which he alluded to being destructive including practicing when tired or low on mental energy. He states that the app motivated him to pace his practice in relation to future events, which he states ‘avoids things like last minute practice’, which have the tendency to cause unwarranted stress and physical tension. The app also enable the musician to evaluate when he was more productive by looking at past practice sessions and seeing when he was more or less efficient. This meant he could subsequently plan sessions to take advantage of when he had energy to practice effectively. Finally by planning sessions it empowered him to input scheduled breaks and avoid getting worn out and forgetting how long he had been going for.

Who should implement it?

Implementation of the app should primarily be guided by the conservatoire and introduced to students as soon as they join the institution to ensure best chances

of establishing good practice habits early on in their studies. To encourage students to use it, conservatoires might consider integrating the app as part of a health and wellbeing module, such as that seen at the RCM entitled 'Healthy Body, Healthy Mind, Healthy Music', which is aimed at equipping young musicians with the skills to maintain healthy careers in music, where usage of the app and the data logged could become part of a final assessment. It is important to note here that the app can be accessed on both android, iPhone and also via a web page with the intention to make it accessible to all. Once the app has been implemented, sustaining its use should be encouraged by principle instrumental teachers who have been identified as those who first year conservatoire students rely heavily on for advice (Williamon & Thompson, 2006). As seen with the 'Training peaks' app, coaches are able to see athletes schedules and help give advice, although teachers wont have access to students practice diaries, principle instrumental/vocal teachers could be involved in supporting students use the app by helping them to plan effective practice sessions. Principle teachers and staff at the conservatoire could be also be involved with the blog where they could offer advice and guidance to students using the app and share their expertise.

Conclusion

This essay examined the possible implementation of a specially designed practice application that aims to address some of the common practice behaviours associated with injury. It could be suggested that the practice application would be a good method to promote healthy practice behaviours by encouraging conservatoire students to undertake a series of measures to avoid injury, including: warming up, pacing practice over time in relation to musical events, taking breaks, evaluating when one works most effectively and encouraging musicians to seek advice and help for injuries via an anonymous platform. Unlike in sports, in which the athlete works under the watchful eye of a coach, music students have to become their own coaches and therefore it is increasingly important that they establish preventive measures early on in their careers (Lehmann, Sloboda, & Woody, 2007). Integrating the app as part of the

curriculum within the conservatoire setting seems like the ideal way to not only introduce the application but also encourage students to use it and establish healthy behaviours for successful, rewarding and sustainable careers in a challenging profession.

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